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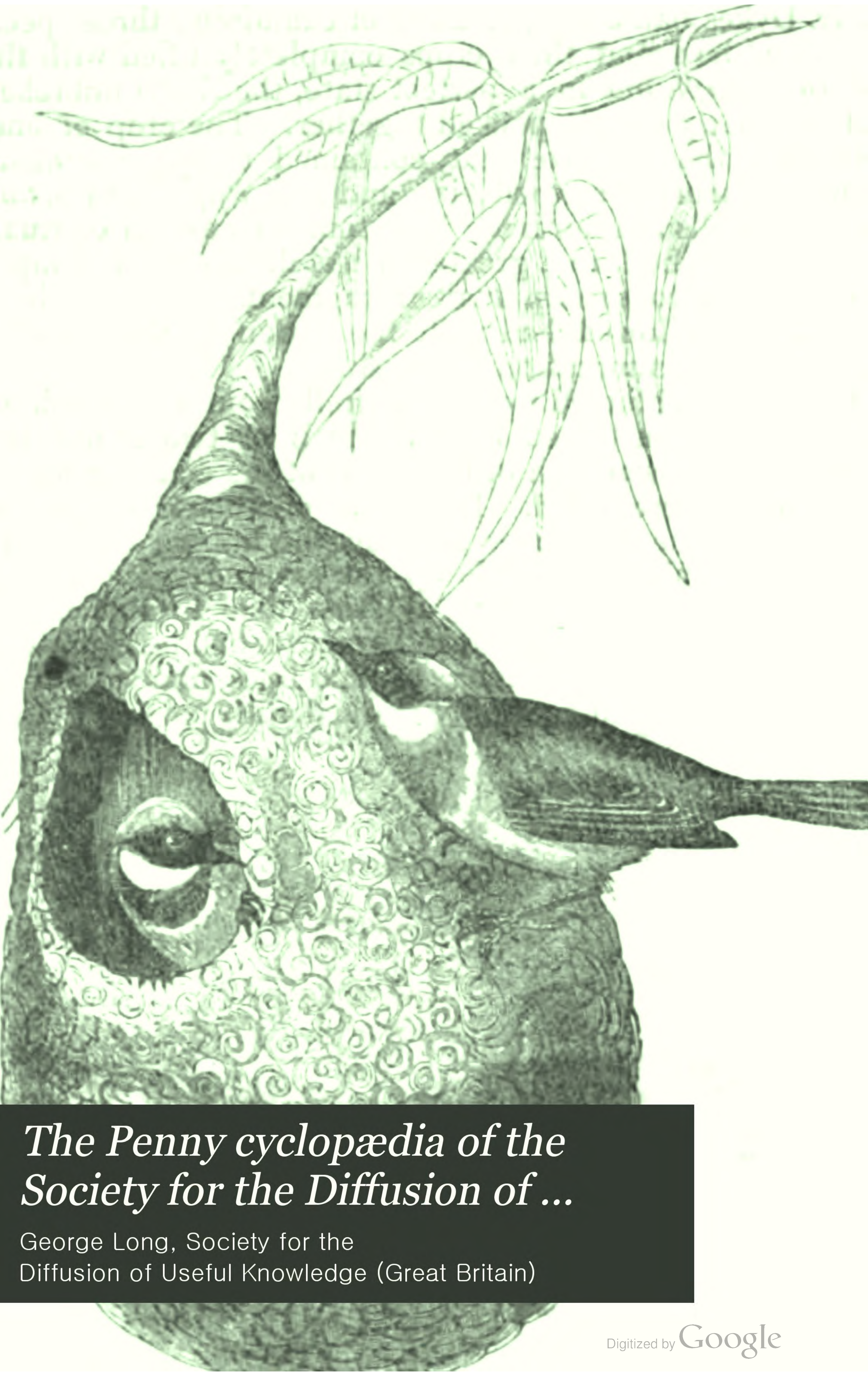

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TITLES OF HONOUR are words or phrases which certain persons are entitled to claim as their right, in consequence of certain dignities being inherent in them. They vary in a manner corresponding to the variety of the dignities, or, in other words, with the rank of the possessor. Thus Emperor, King, Czar, Prince, are titles of honour, and the possessors of the high dignities represented by these words are, by the common consent of the civilized world, entitled to be so denominated, and to be addressed by such terms as Your Majesty and Your Royal Highness. These are the terms used in England, and the phrases in use in other countries of Europe do not much differ from them. In fact one European nation seems to have borrowed from another, or all to have taken their titles of honour for this exalted rank from a common original; so that little of the peculiar genius of the European nations can be traced in the terms by which they show their respect for the persons of highest dignity. But it is different when we come to compare them with the Oriental nations. In those seats of antient civilization the most extravagant terms of compliment are in use, and a little sovereign of a wandering tribe rejoices in titles of honour numerous and inflated in the highest degree. In the series of Roman emperors, the word Cæsar, originally the name of a family, became a title of honour; Augustus was another; and Pater Patriæ a third.

The five orders of nobility in England are distinguished by the titles of honour, Duke, Marquis, Earl, Viscount, and Baron: and the persons in whom the dignity of the peerage inheres are entitled to be designated by these words; and if in any legal proceedings they should be otherwise designated, there would be a misnomer by which the proceedings would be vitiated, just as when a private person is wrongly described in an indictment; that is, the law or the custom of the realm guarantees to them the possession of these terms of honour, as it does of the dignities to which they correspond. They are also entitled to be addressed by such phrases as My Lord, My Lord Marquis, My Lord Duke, and they have usually prefixed to their titles, properly so called, certain phrases, as High and Mighty Prince, Most Noble, Right Honourable, varying with the kind and degree of the dignity possessed by them. The other members of the families of peers have also their titles of honour. Thus the lady of a peer has rank and titles corresponding with those of the husband. All the sons and daughters of peers are Honourable, but the daughters of earls and peers of a higher dignity are entitled to the distinction of being called Lady, and the younger sons of dukes and marquises are by custom addressed as My Lord.

The orders of nobility in other European countries differ little from our own. They have their Dukes, Marquises, Counts, Viscounts, and Barons. We cannot enter into the nice distinctions in the dignities of foreign nations, or in the titles of honour which correspond to them.

Another dignity which brings with it the right to a title of honour is that of knighthood. This dignity is of very antient origin, and, in the form in which we now see it, may be traced far into the depths of the middle ages, if it be not, as some suppose, a continuation of the Equites of Rome. Persons on whom this honour is conferred take rank above the gentlemen and esquires, and are entitled to the prefix Sir to their former name and surname. Their wives also are entitled to prefix the word Dame, and to be addressed by the compellation Your Ladyship or My Lady. The Knights of particular Orders, as of the Garter, the Thistle, St. Patrick, the Bath, are a kind of select number of the body of the knighthood, and the name of the Order to which they belong is ordinarily used by and of them, and thus becomes of the nature of a title of honour. The Bannerets of former ages were a class of knights superior to the ordinary knight-bachelor, forming in fact an Order intermediate between the knight, in its ordinary sense, and the baron. The Baronet, which is quite a new dignity, not having been known before the reign of James I., has, besides its name, which is placed after the name and surname of the person spoken of, the privilege of prefixing Sir; and their wives are entitled to the prefix of Dame, and to be addressed as My Lady and Your Ladyship.

Besides these, there are the ecclesiastical dignities of Bishop and Archbishop, which bring with them the right to certain titles of honour besides the phrases by which the dignity itself is designated. And custom seems to have sanctioned the claim of the persons who possess inferior dignities in the church to certain honourable titles or compellations, and it is usual to bestow on all persons who are admitted into the clerical order the title of Reverend.

There are also academical distinctions which are of the nature of titles of honour, although they are not usually considered to fall under the denomination. Municipal offices have also titles accompanying them; and in the law there are very eminent offices the names of which become titles of honour to the possessors of them, and which bring with them the right to certain terms of distinction.

All titles of honour appear to have been originally names of office. The earl in England had in former ages substantial duties to perform in his county, as the sheriff (the Vice-Comes or Vice-Earl) has now; but the name has remained now that the peculiar duties are gone, and so it is with respect to other dignities. The emperor or king, the highest dignity known in Europe, still performs the duties which originally belonged to the office, or at least the most important of them, as well as enjoys the rank, dignity, and honours; and on the Continent there are dukes and earls who have still an important political character.

Some of these dignities and the titles correspondent to them are hereditary. So were the eminent offices which they designate in the remote ages, when there were duties to be performed. Hence hereditary titles.

The distinction which the possession of titles of honour gives in society has always made them objects of ambition; and it may be questioned whether, as far as there has been any feeling in operation besides that of a sense of duty, the great exertions which are made in the service of the country are not stimulated less by the expectation of pecuniary reward, than by the hope of receiving one of these titles of honour which shall descend to a man's posterity. They cost nothing; and hence it is that titles of honour have been called 'the cheap defence of nations.'

Whoever wishes to study this subject in all its details will do well to resort to two great works: one, the late 'Reports of the Lords' Committees on the dignity of the Peerage;' the other, the large treatise on 'Titles of Honour,' by the learned Selden. The latter was first printed in 4to., 1614; again, with large additions, folio, 1631.

TITMICE, *Paridæ*, a natural family of *Perching Birds*. [INSESSORES.]

Linnæus, in his last edition of the *Systema Naturæ*, placed the genus *Parus* between *Pipra* and *Hirundo*, in his order *Passeres*.

Latham arranges it also at the end of the same order.

Pennant too gives it a place in the Passerine section, between the Warblers and the Swallows.

M. de Lacépède places it immediately before the Larks; M. Duméril in the eighth family of the *Passeres* (*Subulirostres*, or *Raphioramphes*), in company with the Manakins, Larks, and *Bec-fins*; M. Meyer, in the third suborder (*Subulatæ*) of his fifth order (*Oscines*), between *Alauda* and *Regulus*; Illiger, at the head of the *Passerini*, among the *Ambulatores*, immediately before *Alauda*; Cuvier, among the *Conirostres*, directly after the Larks; Vieillot, in the family of *Ægithales* in the tribe *Anisodactyli*; Temminck, in the order *Granivores*, between the Larks and Buntings; and Latreille in the family *Conirostres*, also between the Larks and the Buntings. Selby arranges it between the same two forms.

Mr. Vigors places the genus *Parus* among the *Pipridæ*, in his order DENTIROSTRES. In his paper *On the Natural Affinities that connect the Orders and Families of Birds*,* he remarks that the true *Wrens* of the *Sylviadæ*, a family which in his arrangement immediately precedes the PIPRIDÆ, display in their general appearance and habits so close a similarity to *Parus*, Linn., the Titmouse of our naturalists, that we may at once acknowledge the affinity between the latter family and that of *Pipridæ*, upon which he enters by means of the *Pari*. 'And who is there,' he asks, 'that has not been attracted by the interesting manners of both these familiar visitors of our domestic haunts, and at the same time has not been struck with their resemblance?' The *Penduline Titmouse, Parus pendulinus*, Linn., with its bill longer and more slender than that of the *Pari* in general, seems to him to be the connecting link between the families. That species, he observes, is immediately met by the genus *Tyrannulus* of M. Vieillot, which in the name of *Roitelet Mesange* (Titmouse-Wren), conferred by Buffon on the American species of which it is composed, happily illustrates the affinity which he has pointed out. It is pleasing, he remarks, to trace in groups which bear a general affinity to each other in their more essential characters, an affinity also in less consequential particulars, and he calls attention to the fact that this is the case in the conterminous groups of *Wrens* and *Titmice* with respect to their mode of nidification; for the greater portion of both make their nests in holes of trees, but those groups which most nearly approach each other, viz., *Regulus*, *Tyrannulus*, and *Parus pendulinus*, suspend theirs from the branches, leaving the orifice at the centre, and interlacing the materials of which it is composed with corresponding ingenuity and elegance. Mr. Vigors goes on to remind his readers that the affinity between these birds has been acknowledged by scientific as well as by common observers; and yet the former have generally ranked the *Pari* in a different tribe, and some indeed have even arranged them in a different order from the *Sylviadæ*, in consequence of their more conical bill and the absence of the mandibular notch. A rigid deference to those particulars which form the characteristics of the conterminous subdivisions would, he admits, certainly exclude the *Pari* from the tribe of *Dentirostres*; but the nature of their food, which consists chiefly of insects, and the similarity of their habits, give them, he thinks, a more natural connection with the families among which he has placed them, than with the hard-billed and granivorous birds, where they are generally stationed. 'Here,' says Mr. Vigors in continuation, 'it may also be observed that they form part of one of the extreme families of the tribe, and are immediately connected with a group of the preceding family of the *Sylviadæ*, which passes on to the *Conirostres*, the succeeding subdivision of the order. They thus are brought into contact with the tribe to which the strength and the conical structure of their bill indicates a conformity; while at the same time they maintain their station among the groups where their manners and general economy would naturally place them. The *Pari*, which thus introduce us into the present family, lead us on to the more typical groups of the Linnean *Pipræ*, with which they bear an acknowledged affinity in manners and general appearance. The genus *Pardalotus*, Vieill., which is the representative of the latter group in Australasia, appears to connect these two allied groups of the Old and the New World, by exhibiting the nearly divided foot of the one, and the partially curved bill of the other. Here come in the RUPICOLA, Briss., and PHIBALURA, Vieill. And here, as I have already observed, when speaking of the Thrushes [MERULIDÆ, vol. xv., p. 121], I apprehend that all those groups will be found to assemble, which, connected with *Ampelis*, Linn., are generally denominated *Berry-eaters* and *Chatterers*; such as *Bombycilla*, Briss., the true *Ampelis* of authors, *Casmarhinchus*, Temm., and *Procnias*, Ill. To these the genus *Querula* of M. Vieillot may, I think, be added. This group, the type of which is the *Muscicapa rubricollis* of Gmelin, is strongly allied by its bill to the foregoing genera, while its habits equally ally it to the family of MUSCICAPIDÆ, which follows. The interval between the present groups and those of the *Pari*, where we entered on the family, appears to be filled up by a race of birds peculiar to New Holland, and hitherto uncharacterized, of which the *Muscicapa pectoralis*, Lath., is the type. These, uniting many external characters, at least, both of the *Berry-eaters* and *Fly-catchers*, exhibit also in general appearance a considerable resemblance to the *Pari*, and will be found, I conjecture, to be the connecting bond between all these groups. The affinity between this last family of the tribe and the *Muscicapidæ*, which first met our attention as we entered it, has already been observed when I spoke of the separation of the broad-billed *Chatterers* from the *Thrushes*. And thus equally, as in the former tribe, we may recognise the completion of a circular succession of affinities between all the families of the *Dentirostres*.'

The uncharacterized group above alluded to was afterwards formed into the genus *Pachycephala*, Sw.

Mr. Swainson (*Classification of Birds*) enters among the Titmice by the American genus *Seiurus*, remarkable for the motion of its tail. One species, *Seiurus aquaticus*, Sw., frequents the sides of streams and runs upon the ground, whilst another, *S. aurocapillus*, Sw., is, he observes, confined to damp woods and runs along the low branches of trees. Here Mr. Swainson sees a change of economy, which, he says, plainly shows that nature has assumed a new form; and as the habit of running along branches of trees is the chief faculty of the Scansorial birds, *or of their representatives*, so, he remarks, we may suppose that the group next in succession to the *Motacillinæ* would possess something of the same characters. These he finds manifested in the genus *Accentor*, and he adverts to an unpublished notice which he heard read at a meeting of the Linnean Society of London, relating to the habits of an *Accentor* which was killed near one of the public buildings at Oxford, and which was seen to climb so adroitly round the steep abutments of those buildings as to baffle for a considerable time the aim of the person who shot it. He also states that he has seen the common Hedge-sparrow frequently hop along the whole length of a strong oblique branch, pecking into the crevices of the bark so as to remind the observer of a scansorial creeper, or of a Woodpecker: and he makes the Titmice a subfamily of the SYLVIADÆ, with the genera and subgenera which will be found in that article. [Vol. xxiii., p. 441.]

He remarks that this subfamily may be said to commence with the genus *Accentor*, which stands at the confines of that group which contains the most scansorial warblers in the family of the *Sylviadæ*. 'The short, stout, and nearly conic bills of these active little climbers,' says Mr. Swainson, 'are admirably adapted for pecking into the bark of buds, and thus extracting the small insects that there lie concealed.' Of the five types of form, or subgenera, proper to the genus *Parus*, that which Mr. Swainson formerly named *Parisoma* is, he thinks, the connecting link to *Accentor*. It is, he observes, one of those small birds of South Africa figured by Le Vaillant, but of which the greater part are known only by his plates: the four others are composed of the ordinary or typical Titmice (*Parus*), the Hangnest Titmice (*Ægithalus*, Vig.), the Brazilian Titmice (*Hylophilus*, Temm.), and *Ægithnia*, Vieill. *Parus* and *Ægithalus*, he remarks, are distinguished by their conic, sharp-pointed, and entire bills, while the three aberrant types have that organ notched; but he points out that in all five the feet, so constantly employed in the great exertion of climbing, are particularly strong and muscular; and that the hind-toe also, upon which all climbing birds depend so much for assistance, is large and powerful. 'The discovery of the five subgenera of *Parus*,' says Mr. Swainson in continuation, 'independent of the verification they afford by their perfect analogy to the correctness of the corresponding types of the genus *Sylvicola*, subsequently detailed, is of much importance, since this discovery enables us to prove, beyond all reasonable doubt, that neither the long-tailed nor the bearded tits (*Parus caudatus* and *biarmicus*) are types either of genera or subgenera. We have already alluded to the station in which, after the most minute analysis, we have placed the *Parus biarmicus*,[*] which is only an aberrant species of the restricted subgenus *Parus*, as the latter now stands: from this bird always living in the vicinity of water, it becomes that species which represents the natatorial type; while in the greatly developed tail of *Parus caudatus* it is easy to perceive another aberrant species typifying the *Rasores*. We have repeatedly remarked that groups preeminently typical in their own circle, almost invariably present us with these variations in the form of their aberrant species. The restricted genus *Parus* is precisely of this description: it is the preeminent type of an entire subfamily; and hence, like *Corvus*, *Lanius*, *Sylvia*, and a great number of other genera holding the same rank in their own circles, it contains a greater variety of modifications in the form of its species than genera which are not preeminently typical. The whole of the subgenera of *Parus* are distinguished from those of *Sylvicola* by characters the most simple and beautiful. They all have that peculiar strength of foot so conspicuous in our native examples, and their wings are invariably rounded; that is to say, the first quill is short, and the second and third so graduated that the fourth becomes the longest. The bill also is short and thick, generally more or less conic, and sometimes (as in the types) very strong: the upper mandible may be said to be entire, for in the only genus (*Parisoma*) which has the culmen arched, the notch is so small that it may be termed obsolete.' Mr. Swainson then remarks that we are thus enabled to distinguish the whole from the neighbouring group, *Sylvicola*, which he then enters upon.

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* 'Linn. Trans.,' vol. xiv.

Notwithstanding the discovery here claimed, and the assumed proof that neither the *Long-tailed* nor the *Bearded Tits* are types either of genera or subgenera, we shall presently find that ornithologists, in their publications subsequent to that of Mr. Swainson, are not convinced; but, on the contrary, still regard these two interesting forms as generic types.

Mr. Yarrell places the *Paridæ*, or True Tits, between the Warblers, *Sylviadæ*, and the *Ampelidæ*, the latter being represented by the Bohemian Waxwing. [BOMBYCILLA.]

The Prince of Canino (*Birds of Europe and North America*, 1838) arranges the *Parinæ* as the seventh subfamily of the *Turdidæ*, placing it between the *Motacillinæ* (Wagtails) and the *Sylvicolinæ*. The following genera are included by the Prince under the *Parinæ*:—

Regulus, Ray (*Wren*, including *Gold-Crests*); *Parus*, Linn.; *Mecistura*, Leach (*Paroides*, Brehm,—*Long-tailed Titmouse*); *Calamophilus*, Leach (*Mystacinus*, Brehm—*Bearded Titmouse*); *Ægithalus*, Vig. (*Pendulinus*, Cuv.—*Penduline Titmouse*).

Mr. G. R. Gray (*List of the Genera of Birds*, 1841) makes the *Parinæ* the fifth subfamily of his *Luscinidæ*, and places it between the *Accentorinæ* and the *Sylvicolinæ*: the *Parinæ*, according to him, consist of the following genera:—

Ægithalus, Vig.; *Melanochlora*, Less.; *Parus*, Linn.; *Megistina*, Vieill.; *Tyrannulus*, Vieill.; *Sphenostoma*, Gould; *Calamophilus*, Leach; *Orites*, Mæhr (*Mecistura*, Leach; *Paroides*, Brehm—*Long-tailed Titmouse*); *Parisoma*, Sw.; *Psaltria*, Temm.; *Ægithina*, Vieill.; *Hylophilus*, Temm.

In this article we shall confine ourselves to those cognate forms which are vernacularly known as *Titmice*.

EUROPEAN TITMICE.

The following species are found in Europe:—

The Great Tit, *Parus major*; the Sombre Tit, *Parus lugubris*; the Siberian Tit, *Parus Sibericus*; the Toupet Tit, *Parus bicolor*; the Azure Tit, *Parus cyaneus*; the Blue Tit, *Parus cæruleus*; the Coal Tit, *Parus ater*; the Marsh Tit, *Parus palustris*; the Crested Tit, *Parus cristatus*; the Long-tailed Tit, *Parus caudatus* of authors (genus *Orites*); the Bearded Tit, *Parus biarmicus* (genus *Calamophilus*); the Penduline Tit, *Parus pendulinus* of authors (genus *Ægithalus*).

Of these, the *Great Tit*, the *Blue Tit*, the *Crested Tit*, the *Coal Tit*, the *Marsh Tit*, the *Long-tailed Tit*, and the *Bearded Tit* are British.

There is little doubt that the *Tits* are the Αἰγιθαλοί (*Ægithali*) of Aristotle. The Great Tit, the Long-tailed Tit, and the Blue Tit are referred by Belon to the *αἰγιθαλός*, the *αἰγιθαλός ἕτερος*, and the *τρίτος αἰγιθαλός* of that author, and, we think, with good reason.

The Great Tit, the Blue Tit, the Coal Tit, and the Marsh Tit are too well known to require description; but a sketch of their habits may not be unacceptable. White, speaking of the English Tit, says:—'Every species of titmouse winters with us: they have what I call a kind of intermediate bill between the hard and the soft, between the Linnæan genera of *Fringilla* and *Motacilla*. One species alone spends its whole time in the woods and fields, never retreating for succour in the severest seasons to houses and neighbourhoods;[*] and that is the delicate Long-tailed Titmouse, which is almost as minute as the Golden-crowned Wren; but the Blue Titmouse or Nun (*Parus cæruleus*), the Coal-Titmouse (*Parus ater*), the Great Black-headed Titmouse (*Fringillago*), and the Marsh Titmouse (*Parus palustris*), all resort at times to buildings, and in hard weather particularly. The Great Titmouse, driven by stress of weather, much frequents houses; and, in deep snows, I have seen this bird, while it hung with its back downwards (to my no small delight and admiration), draw straws lengthwise from out the eaves of thatched houses, in order to pull out the flies that were concealed between them, and that in such numbers that they quite defaced the thatch, and gave it a ragged appearance. The Blue Titmouse, or Nun, is a great frequenter of houses, and a general devourer. Besides insects, it is very fond of flesh; for it frequently picks bones on dunghills: it is a vast admirer of suet, and haunts butchers' shops. When a boy, I have known twenty in a morning caught with snap mouse-traps baited with tallow or suet. It will also pick holes in apples left on the ground, and be well entertained with the seeds on the head of a sun-flower. The Blue, Marsh, and Great Titmice will, in very severe weather, carry away barley and oat straws from the sides of ricks.' (*Selborne*.)

We can confirm, if confirmation were needed, the account of this admirable observer relative to the straw-extracting labours of the Great Tit. The thatch of a root-house in Gloucestershire was nearly destroyed by those fly-seekers: but they have more to answer for than fly-catching; they are small-bird murderers, and frequently kill their victims by repeated blows on the head with their strong, sharp, and hard beak, for the sake of feasting on the brains.

The Great Tit, without any compass to speak of, is a songster, not unadmired by some for its few but lively notes heralding the spring early in February. The quatrain in the *Portraits d'Oyseaux* is loud in its praise:—

'Au temps d'Autonne il y a des mesanges,
En grand foison, qui hantent par les boys,
Et font des œufs douze ou quinze par fois.
Oyseaux petits et qui chantent comme anges.'

The habits of the Blue Tit are recorded by White with equal truth: this is the bird that fights so stoutly *pro aris et focis*, hissing like a snake or an angry kitten wh her nest in the hollow of some decayed tree is invade the school-boy, who, if not deterred by the ominous sounds, often rues his temerity and draws back his hand with more celerity than he stretched it forth, well pecked by the irritated matron. Hence he calls it 'Billy Biter:' by the way Montagu gives 'Willow Biter' as one of its names. The latter name does not convey much meaning to any one acquainted with the habits of the bird; the former does: may not Montagu have heard it imperfectly?

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[*] 'Classification of Animals,' pp. 270, 271.

[*] But see post, description of that species.

The gardener, who sees this little bird busy about the buds, likes it not, and in some parishes a reward has been set upon its head. Mr. Knapp, in his interesting *Journal of a Naturalist*, notices such a case where the stimulus appears to have operated to some purpose against these innocent little birds, for one item passed in the church-wardens' account was 'for seventeen dozen of Tomtits' heads.' They may, now and then, knock off a bud in their busy search for insects; but the great good they do in ridding the plants of these, far outweighs any casual harm that may result from their industry.

The song of the Tomtit has but little variety: the yivacity of the bird seems however to have found favour for its song with our neighbours, for the *Portraits d'Oyseaux* notices it with applause:—

'L'Esté es bois la mesange bleuë est,
Et nous vient voir en Hyver et Autonne,
Le doux chanter d'icelle plaisir donne
A tout esprit, à qui l'escouter plaist.'

We proceed to illustrate the present article by the less familiar Long-tailed Titmouse, Bearded Titmouse, and Penduline Titmouse.

Long-tailed Titmouse.

Description.—Male.—Head, neck, throat, and breast pure white; upper part and centre of the back, rump, and the six middle tail-feathers deep black; scapulars reddish; belly, sides, and abdomen reddish white; quills black; greater wing-coverts bordered with pure white; lateral tail-feathers white on their external barbs and at their end; tail very long and wedge-shaped. Length five inches seven or eight lines.

Female.—A large black band above the eyes, which is prolonged upon the nape, and proceeds to unite itself with the black of the upper part of the back.

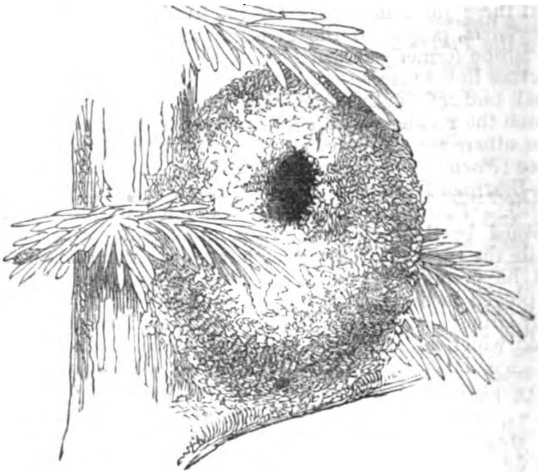
Young.—Small black spots on the cheeks and brown spots on the breast: black of the back not so decided. (Temm.)

N.B. Mr. Gould remarks that the female does not differ from the male in colouring, and in the *Birds of Europe* both are represented with the black band above the eyes.

This is the *Pendolino*, *Paronzino*, *Codibugnolo*, and *Paglia in culo* of the Italians; *Mésange à la longue queue* and *Perd sa queue* of the French; *Langschwänzige Meise*, *Schwanzmeise*, and *Belzmeise Pfannenstiel* of the Germans; *Staartmees* of the Netherlanders; *Alhtita* of the Swedes; *Jenaga* of the Japanese; *Bottle Tit*, *Bottle Tom*, *Long-tailed Farmer*, *Long-tail Mag*, *Long-tail Pie*, *Poke Pudding*, *Huckmuck*, and *Mum-ruffin*, of the modern British; and *Y Benloyn gnyffonhir* of the antient British.

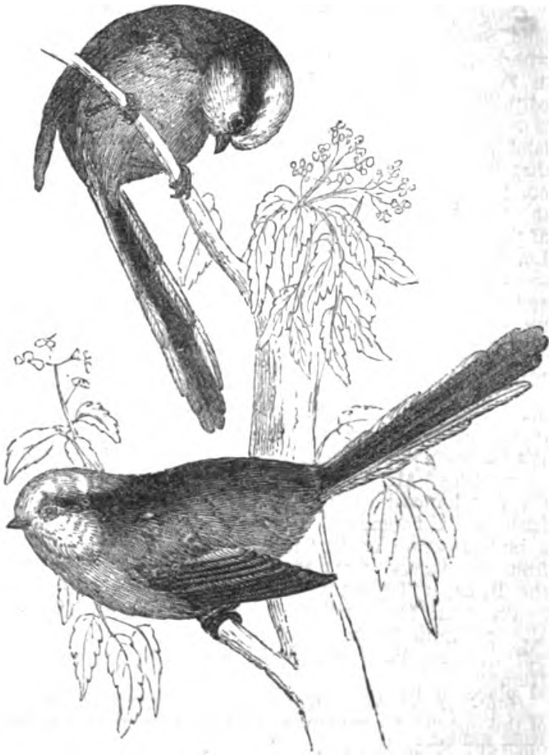
Geographical Distribution.—Siberia, Russia, Japan. The whole of Europe. England, Scotland (near Edinburgh at least), and Ireland.

Habits, Food, &c.—Insects, their larvæ and eggs, form the food of these pretty little birds. When White says that the Long-tailed Titmouse never retreats for succour in the severest seasons to houses and their neighbourhood, he must not be supposed to mean that the bird avoids the haunts of men. We have seen in a nursery-garden in Middlesex a whole family of them within a few yards of the nursery-man's cottage, and close to his greenhouse, which visitors were constantly entering, and we have found its exquisitely wrought nest in a Silver Fir about eight feet high, in a pleasure-ground in the same county, little more than a hundred yards from the house. Pennant well describes its appearance in flight when, after stating that the young follow the parents the whole winter, he says, 'from the slimness of their bodies, and great length of tail, they appear, while flying, like so many darts cutting the air. They are often seen passing through our gardens, going progressively from tree to tree, as if on their road to some other place, never making any halt.' Yarrell is equally happy in describing the nest and [illegible]ers of this interesting little bird. 'The nest of this [illegible] says he, 'is another example of ingenious con-



Nest of Long-tailed Titmouse.

struction, combining beauty of appearance with security and warmth. In shape it is nearly oval, with one small hole in the upper part of the side by which the bird enters. I have never seen more than one hole. The outside of this nest sparkles with silver-coloured lichens adhering to a firm texture of moss and wool, the inside profusely lined with soft feathers. The nest is generally placed in the middle of a thick bush, and so firmly fixed, that it is mostly found necessary to cut out the portion of the bush containing it, if desirous of preserving the natural appearance and form of the nest. In this species, the female is known to be the nest-maker, and to have been occupied for a fortnight to three weeks in completing her habitation. In this she deposits from ten to twelve eggs; but a larger number are occasionally found: they are small and white, with a few pale red specks, frequently quite plain, measuring seven lines in length, and five lines in breadth. The young family of the year keep company with the parent birds during their first autumn and winter, and generally crowd close together on the same branch at roosting-time, looking, when thus huddled up, like a shapeless lump of feathers only. These birds have several notes, on the sound of which they assemble and keep together; one of these call-notes is soft and scarcely



Long-tailed Titmouse, Male and Female. (Gould.)

audible; a second is a louder chirp or twitter, and a third is of a hoarser kind.'

In the *Portraits d'Oyseaux* the qualities of this species are thus summed up:—

> 'Ceste Mesange est à la longue queue
> Oyseau petit, comme est le Roytelet:
> Du demeurant, inconstant, et follet,
> Par son hault chant sa voix est bien cogueue.'

The Bearded Titmouse.

Description.—Male.—Black between the bill and the eye, and these black feathers are very long and prolonged on each side on the lateral part of the neck; head and occiput bluish ash; throat and front of the neck pure white, which blends on the breast and the middle of the belly into a rosy hue; nape, back, rump, feathers of the middle of the tail and sides fine rust-colour; great coverts of the wings deep black, bordered with deep rusty on the external barb, and reddish white on the internal barb; quills bordered with white; feathers of the under part of the tail deep black; lateral tail-feathers bordered and terminated with grey; tail long, much graduated; bill and iris fine yellow. Length 6 inches and 2 or 3 lines.

Female.—No black moustaches; throat and front of the neck tarnished white; upper parts of the head and body rusty, shaded with brown; on the middle of the back some longitudinal black spots; under tail-coverts bright rusty.

Young at their leaving the nest, and before their first moult, with nearly the whole of the plumage of very bright reddish; a good deal of black on the external barbs of the quills and tail-feathers; on the middle of the back a very large space of deep black. After the first moult nothing of the deep black of the back remains but some longitudinal spots.

Varieties.—More or less marked with white or whitish; the colours of the plumage often feebly developed. (Temm.)

This is the *Mésange Barbue* ou *Moustache* of the French; *Bartmeise* of the Germans; *Least Butcher-Bird* of Edwards; *Reed Pheasant* (provincial) of the modern British, and *Y Barfog* of the Welsh.

N.B. M. Temminck remarks that the *Zahnschäblige Bartmeise* of Brehm is a species or subspecies founded only on individuals which have been long caged, such as may be seen in the Dutch markets, where numbers are sold. Some of these captives come to London, where they may be bought for some four or five shillings a pair. The iris and bill in the living bird are of a delicate orange-colour.

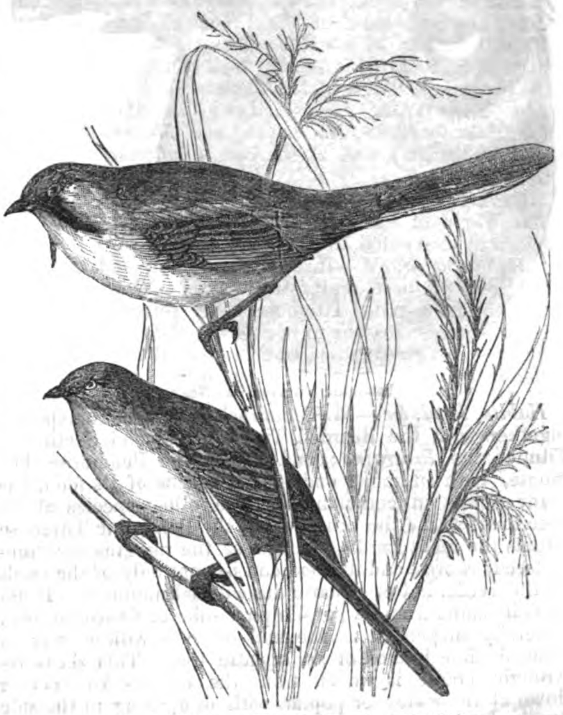
Geographical Distribution.—The north of Europe, England, Sweden; Asia, on the shores of the Caspian Sea; nowhere so abundant as in Holland; accidentally, on passage, in France. (Temm.) In the third part of the second edition of his *Manuel*, M. Temminck says, that in Italy it is as common in the marshes of Ostia, as in those of Holland near Amsterdam. As to Sweden, Pennant also states that it is rarely found there; but neither Müller, Brisson, nor Nilsson notices it in that locality. Mr. Yarrell gives the best summary known to us of the recorded distribution of the species in the British Islands:—'South and west of London the Bearded Tit has been found in Surrey about some ponds near Godalming; in Sussex near Winchelsea; and on the banks of the Thames from London upwards as far as Oxford. Pennant says it has been taken near Gloucester. In Cornwall, as I learn from Mr. Rodd, it is considered very rare; a single specimen was obtained in the neighbourhood of Helston, which is now in the collection made by the late Humphrey Grylls, Esq. It is not included in he catalogue of the Birds of Shropshire and North W tely published in the "Annals of Natural History" by nd Mr. Thomas Eyton; but is said to have been tak ncashire; and a single specimen is recorded as Iris Thompson, on the authority of Mr. W. S. Wall, a bir ver in Dublin, which example was received from nks of the Shannon. Eastward from London the B Tit inhabits the various reed-beds on the banks hames, both in Kent and Essex. It is found also in lgeshire, Suffolk, Norfolk, and Lincolnshire, but has een traced in this country north of the Humber.'

Habits, &c.—Dr. Leach had observed the fondness of this spe marshy and reedy spots, the shape of its open cup-s est placed on the ground, and the nature of its food insects and their larvæ, and small-shelled snails. He had also remarked that the sides of the stomach in this bird were muscular and much thickened, forming a gizzard which the true tits do not possess; and that this structure of the stomach afforded the power of breaking down the shells of the testaceous mollusks—*Succinea amphibia* and *Pupa muscorum*—many of which had been found comminuted therein. Still, from the comparative rarity of this bird in Britain, and the impervious nature of its haunts, its habits were comparatively little known. Mr. Hoy and Mr. Dykes have supplied much interesting information on this head.

The former states that the Bearded Tit begins building towards the end of April, and that the nest is composed on the outside of dead leaves of the reed and sedge, intermixed with a few pieces of grass, and lined with the top of the reed. He describes it as generally placed in a tuft of coarse grass or rushes near the ground, on the margin of the dikes, in the fens; and sometimes as fixed among the reeds that are broken down, but never suspended between the stems. Their food, he says, is principally the seed of the reed, and so intent were they on their search for it, that he had taken them with a bird-limed twig attached to a fishing-rod. When alarmed by any sudden noise, or the passing of a hawk, they uttered their shrill musical notes, and concealed themselves among the thick bottoms of the reeds, but they soon resumed their station, climbing the upright stems with the greatest facility.

Mr. Dykes had an opportunity of examining three specimens, and he found their crops completely filled with the *Succinea amphibia* in a perfect state, the shells unbroken and singularly closely packed together. The crop of one, not larger than a hazel nut, contained twenty *Succineæ*, some of them of a good size, and four *Pupæ muscorum*, with the shells also entire. The stomach was full of small fragments of shell, in a greater or less degree of decomposition. Numerous sharp angular fragments of quartz which had been swallowed had with the action of the stomach effected the comminution of the shells.

Two nests obtained by Mr. Yarrell from the parish of Horsey, were sustained only an inch or two above the ground by the strength of the stems of the coarse grass on which they were fixed. Each was composed entirely of dried bents, the finer ones forming the lining; others increasing in substance made up the exterior. Mr. Yarrell states the number of eggs at from four to six, rather smaller than those of the Great Titmouse, and less pointed; eight lines and a half long by six lines and a half in breadth, white, and sparingly marked with pale red lines or scratches. (*British Birds.*)



Bearded Titmouse, Male and Female. (Gould.)

Penduline Titmouse.

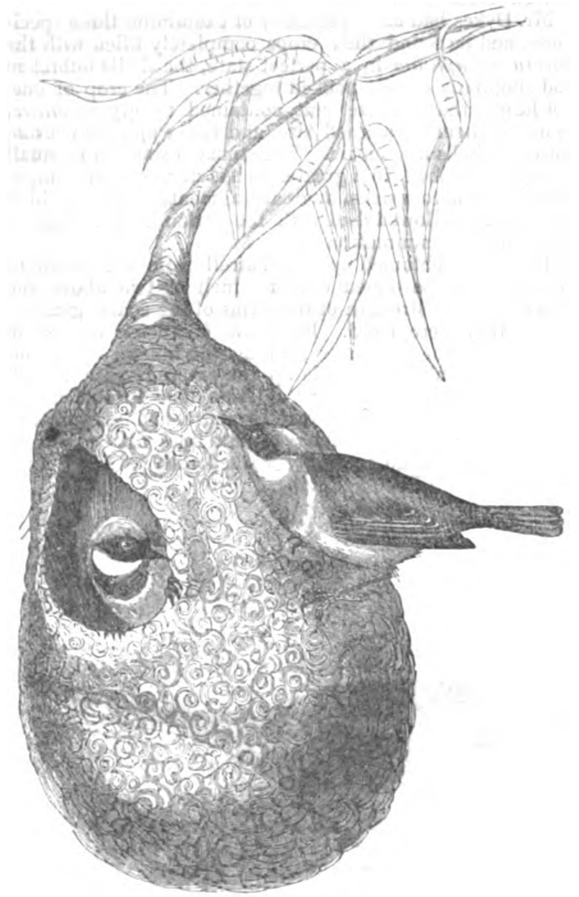
Description.—*Male.*—Bill black, straight, a little elongated, and pointed; tail short; top of the head and nape pure ash-colour; forehead, space between the eye and the bill, region of the eyes, and feathers of the orifices of the ears deep black; back and scapulars reddish grey: rump ash-colour; throat white, the other lower parts whitish, with rosy tints; coverts of the wings chesnut, bordered and terminated with whitish rusty and white; wings and tail blackish, bordered with whitish rusty; tail-feathers terminated with white; iris yellow. Length 4 inches 3 or 4 lines.

Female.—Rather less than the male; the black on the forehead not so large nor so pure; the band which passes over the eyes and terminates at the ears, bluish black; ash-colour of the head less pure; upper parts more clouded with rusty, but there is a yellowish tint on the middle of the belly.

The *young* up to their first moult have the colours brighter; they have not the forehead black.

This is the *Rémiz* or *Mésange de Pologne* of the French, and *Beutel Meise* of the Germans.

Geographical Distribution.—Southern and eastern provinces of Europe principally. Russia, Poland, Hungary, Austria, along the banks of the Danube, where it breeds, south of France and Italy.



Penduline Titmouse and Nest.

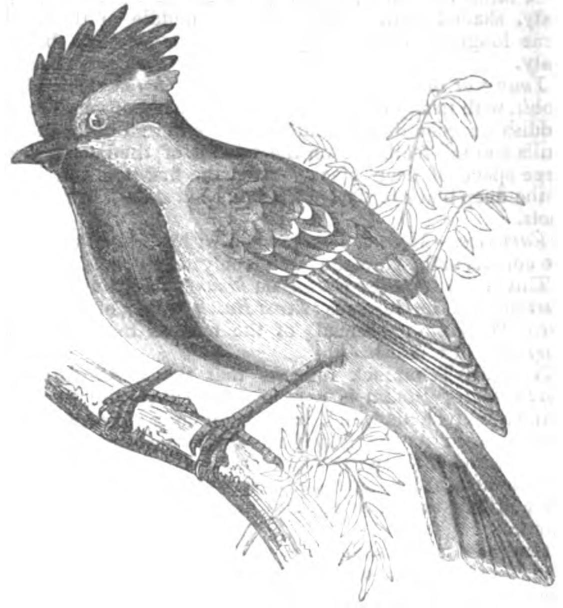
Habits, Food, &c.—M. Temminck has placed this species together with the Bearded Tit in his second Section of Titmice, the *Riverains;* and indeed the Penduline Titmouse, both in habits and in the choice of its food, has many points in common with the other species above described. Like the Bearded Tit, the Penduline Titmouse haunts the reedy banks of rivers, or the margins of 'wide-watered' shores, and its food consists not only of the seeds of the reeds, but of aquatic insects and mollusks. It derives its name from its pensile purse-like or flask-like nest, generally suspended at the end of some willow twig or other flexible branch of an aquatic tree. This skilfully-wrought cradle is woven from the cotton-like wool or down of the willow or poplar, with an opening in the side for the ingress and egress of the artificers and their young, and mostly overhangs the water; sometimes however it is interwoven among the reed-stems. The eggs, which are pure white marked with some red spots or blotches, are generally six in number.

ASIATIC TITMICE.

Example.—*Parus Xanthogenys.*

Description.—Head with a full crest of black feathers; occiput, superciliary stripe, and cheeks yellow; ear-coverts black; back olive; wings and tail black, the former spotted, and the latter tipped with white; a broad black line passing down the throat, and extending along the middle of the abdomen; sides of the chest and flanks pale yellow; bill and feet black; size rather less than that of the Greater Tit, *Parus major*. (Gould.)

Locality, Habits, &c.—The Himalaya Mountains; figured and described, in his 'Century of Birds,' by Mr. Gould, who remarks that the species bears a close resemblance to our *Parus major*, from which it differs principally in its crested head. He further observes that the brilliancy of its colouring is not surpassed by that of any of its congeners, and that its mode of life strictly assimilates to that of the *Pari* in general.



Parus Xanthogenys. (Gould.)

AMERICAN TITMICE.

Example.—*Parus atricapillus*, Black-cap Titmouse.

Description.—*Male.*—Upper aspect of the head, nape, chin, and throat velvet-black. A white line from the nostrils through the eye, spreads out on the side of the neck; back lead-coloured, glossed with yellowish grey, quill and tail feathers blackish grey, edged with greyish white; under-plumage brownish white, deepening in some specimens to yellowish grey; bill pitch black; legs bluish; total length five inches six lines. (*Fauna Boreali-Americana.*)

Some ornithologists have considered this bird identical with the Marsh Titmouse, *Parus palustris*, of Europe. M. Temminck in the first part of his *Manuel* declares that individuals sent to him from North America had absolutely the same distribution of colours on their plumage as those killed in Europe, only the hues of the American individuals were more pure. In the third part, where he notices *Parus palustris*, and adds to its synonyms, he says nothing to contradict his original observation; and in the first part he gives *Parus atricapillus*, *La Mésange à tête noire du Canada* (Briss.), and the *Black-cap* and *Canada Titmouse* (Lath.), as synonyms of *Parus palustris*.

Mr. Swainson and Dr. Richardson however, after referring to the opinions of those who have considered the European and the American bird as the same, state that the two species appear to them to be sufficiently distinct. According to them this tit is the *Parus atricapillus*, Linn., who by the way gives Canada as its habitat; *Mésange à tête noire de Canada*, Buff.; *Black-capt Titmouse*, *Parus atricapillus*, Wils.; *Parus atricapillus*, Bonap.; *Peechek.*

keeskæshees of the Cree Indians; and *Mésange* of the Canadian voyageurs: and they observe that its loose plumage, like that of the Canadian jay, is well qualified for its protection in the severe arctic winters. According to Nuttall, 'Chicadee' is the familiar name for this bird.

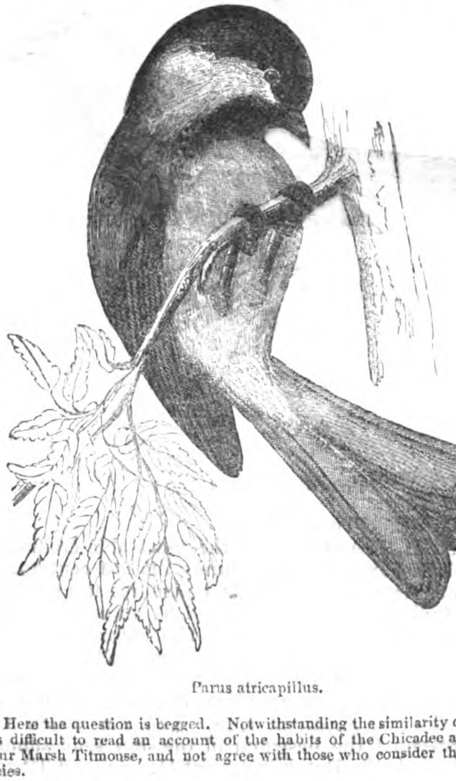
Geographical Distribution.—Supposing the bird to be a distinct species. The whole width of the American continent, from lat. 65° to the southern districts of the United States, throughout the year: one of the most common birds in the fur-countries, a small family inhabiting almost every thicket. (*Fauna Boreali-Americana.*) In winter resident around Hudson's Bay, and has been met with at 62° on the north-west coast. Difficult to say in what part of the United States it is most common, so generally and equally has it colonized the temperate parts. In winter abundant in all the forests of the southern states to Florida, and probably extending its visits into Mexico. (Nuttall.)

Habits, Food, &c.—The author last quoted gives a graphic description of the manners of this titmouse, which would suffer by an attempt to lay it before the reader in any other terms than his own.

'In all these countries,' says the observing author of the *Manual of the Ornithology of the United States and of Canada*, 'in autumn families of them are seen chattering and roving through the woods, busily engaged in gleaning their multifarious food, along with the preceding species' (*Parus bicolor*), 'Nuthatches, and Creepers, the whole forming a busy, active, and noisy group, whose manners, food, and habits bring them together in a common pursuit. Their diet varies with the season; for besides insects, their larvæ and eggs, of which they are more particularly fond, in the month of September they leave the woods and assemble familiarly in our orchards and gardens, and even enter the thronging cities in quest of that support which their native forests now deny them. Large seeds of many kinds, particularly those which are oily, as the sun-flower, and pine, and spruce-kernels, are now sought after. These seeds, in the usual manner of the genus, are seized in the claws and held against the branch until picked open by the bill to obtain their contents. Fat of various kinds is also greedily eaten, and they regularly watch the retreat of the hog-killers, in the country, to glean up the fragments of meat which adhere to the places where the carcasses have been suspended. At times they feed upon the wax of the candle-berry myrtle (*Myrica cerifera*); they likewise pick up crumbs near the houses, and search the weather-boards and even the window-sills familiarly for their lurking prey, and are particularly fond of spiders and the eggs of destructive moths, especially those of the canker-worm, which they greedily destroy in all its stages of existence. It is said that they sometimes attack their own species when the individual is sickly, and aim their blows at the skull with a view to eat the brain; but this barbarity I have never witnessed. In winter, when satisfied, they will descend to the snow-bank beneath, and quench their thirst by swallowing small pieces; in this way, their various and frugal meal is always easily supplied; and hardy, and warmly clad in light and very downy feathers, they suffer very little inconvenience from the inclemency of the seasons. Indeed in the winter, or about the close of October, they at times appear so enlivened as already to show their amorous attachment, like our domestic cock, the male approaching his mate with fluttering and vibrating wings; and in the spring season the males have obstinate engagements, darting after each other with great velocity and anger. Their roost, I suspect, is in the hollows of decayed trees, where they also breed, laying their eggs merely in the dry rotten wood, without any attempt at a nest;[*] these are from 6 to 12 in number, white with specks of brown-red. They begin to lay about the middle or close of April, and though they commonly make use of natural or deserted holes of the woodpecker, yet at times they are said to excavate a cavity for themselves with much labour. The first brood take wing about the 7th or 10th of June, and they have sometimes a second towards the end of July. The young, as soon as fledged, have all the external marks of the adult, the head is equally black, and they chatter and skip about with all the agility and self-possession of their parents, who appear, nevertheless, very solicitous for their safety. From this time the whole family continue to associate together through the autumn and winter. They seem to move by concert from tree to tree, keeping up a continued *'tshe-de-de-de-de* and *'tshe-de-de-de-dait*, preceded by a shrill whistle, all the while busily engaged picking round the buds and branches, hanging from their extremities and proceeding often in reversed postures, head downwards, like so many tumblers, prying into every crevice of the bark, and searching around the roots and in every possible retreat of their insect prey or its larvæ. If the object chance to fall, they industriously descend to the ground and glean it up with the utmost economy.'

'On seeing a cat, or other object of natural antipathy, the Chicadee, like the peevish jay, scolds in a loud, angry, and hoarse note, like *'Tshe, dáigh, dáigh, dáigh*. Among the other notes of this species, I have heard a call like *tshe-de-jay, tshe-de-jay*, the two first syllables being a slender chirp, with the *jáy* strongly pronounced. The only note of this bird which may be called a song, is one which is frequently heard at intervals in the depth of the forest, at times of the day, usually, when other birds are silent. We then may sometimes hear in the midst of this solitude two feeble, drawling, clearly whistled, and rather melancholy notes, like *'te-dĕrry*, and sometimes *ye-pĕrrit*, and, occasionally, but much more rarely, in the same wiry, whistling, solemn tone, *'phēbé*. The young, in winter, also sometimes drawl out these contemplative strains. In all cases the first syllable is very high and clear, the second word drops low, and ends like a feeble plaint. This is nearly all the quaint song ever attempted by the Chicadee; and is perhaps the two notes sounding like the whetting of a saw, remarked of this bird[*] in England by Mr. White, in his *Natural History of Selborne* (vol. i.). On fine days about the commencement of October, I have heard the Chicadee sometimes for half an hour at a time, attempt a lively, petulant warble, very different from his ordinary notes. On these occasions he appears to flirt about, still hunting for his prey, but almost in an ecstasy of delight and vigour. But after a while the usual drawling note again occurs. These birds, like many others, are very subject to the attacks of vermin, and they accumulate in great numbers around that part of the head and front which is least accessible to their feet.'

'The European bird is supposed to be partial to marshy places. Ours has no such predilection, nor does the American bird, that I can learn, even lay up or hide any store



Parus atricapillus.

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[*] N.B. Mr. Nuttall has, here, the following note:—'In Europe however this kind, if the *same* species, as asserted by Temminck, is said to dig out an excavation in decayed willows, in which it makes a nest of moss, thistle-down, and sometimes a little wool and feathers.'

[*] Here the question is begged. Notwithstanding the similarity of plumage, it is difficult to read an account of the habits of the Chicadee and of those of our Marsh Titmouse, and not agree with those who consider them distinct species.

of seeds for provision—a habit reported of the foreign family.'

The Prince of Canino, a valuable authority at all times, but especially in this case, for he has enjoyed opportunities of comparing the American and European birds and their habits, notes *Parus palustris* and *Parus atricapillus* as distinct species, in his *Birds of Europe and North America*.

AFRICAN TITMICE.

Example, *Parus niger*, Vieill. (*Parus leucopterus*, white-winged Tit, Sw.).

Description.—Deep uniform glossy black with slight bluish reflection in certain lights, except the wings, on which the black is relieved by the snowy white of the lesser and greater coverts and of the quills. Total length nearly six inches.

Locality.—Abundant in the Caffre country, South Africa. Mr. Swainson (*Birds of Western Africa*) observes that Le Vaillant states that this species was never met with by him, either on the west coasts or near the Cape of Good Hope, but that this is very singular, since two specimens received from Senegal perfectly agree both with Le Vaillant's figure and description. Mr. Swainson remarks that the size of this bird is exactly that of *Parus major*, and that the structure is nearly the same, except that the bill is rather shorter and the culmen more arched; the feet also, he adds, are somewhat smaller, and their claws shorter, broader, and more curved.

Habits, &c.—Le Vaillant describes the note of this species, his *Mésange noire*, as the same with that of *Parus major*. The nest, he says, is made in the trunks of trees, where the bird also roosts. The pure white eggs, he adds, are from six to eight in number.

Parus Niger. (Le Vaillant.)

TITMOUSE. [TITMICE.]

TITSINGH, ISAAC, one of the most able civilians in the Dutch East Indian service during the last century. He was born at Amsterdam in 1740: he entered the service of the East India Company of Holland at an early age, and rose to the rank of counsellor. His naturally vigorous constitution defied the pestilential effects of the climate of Batavia, where in the course of seventeen years he saw the entire body of his colleagues twice renewed. He was sent as supercargo to Japan in 1778. The war which then raged prevented the despatch of the ship sent annually from Batavia to the Dutch factory at Desima, and Titsingh was in consequence detained there for several years. He did not quit Japan till 1784. After his return to Batavia he was appointed governor of the Dutch factory in the vicinity of Chandernagore: how long he filled this office is uncertain.

In 1794 Titsingh was appointed by the government at Batavia chief of the embassy which Van Braam, hoping to be himself appointed ambassador, had persuaded them to send to the court of Pekin. The mission left Canton on the 22nd of November, 1794, and reached that city on its return on the 11th of May, 1795. The ill-health of Titsingh during the greater part of his residence in Pekin caused the discharge of the functions of ambassador to devolve in a great measure on Van Braam. Not long after the termination of this mission Titsingh returned to Holland, after a residence of about thirty-one years in the East. The involuntary prolongation of his residence in Japan had enabled him to obtain a greater amount of information relative to those islands than his predecessors, and the friendships he had contracted with several of the nobles enabled him to procure, at a later date, by their good offices, material additions to the collections he had made himself. He was acknowledged both by the Japanese and Chinese to possess a knowledge of their customs and manners rare in a European. He was esteemed by his colleagues for his business talents; and the literati of Europe who had applied to him for information had ever found him as courteous and liberal as he was intelligent: consequently great additions to our knowledge of Japan were anticipated on his return to Europe. These expectations have been in a great measure disappointed. With the exception of information which he supplied to Marsden, De Guignes and others, nothing appeared during his life; and after his death, by a fever which he neglected, in February, 1812, his collections were dispersed; only a portion of his manuscripts, maps, and curiosities were ultimately recovered. M. Nepven, who had become the purchaser of the fragments, published in 1819, in two vols. 8vo., 'Cérémonies usitées au Japon pour les Mariages et les Funérailles, suivies de Détails sur la Poudre Doxia, et de la Préface d'un livre de Confoutzée sur la Piété Filiale, traduit du Japonais par feu M. Titsingh.' In the introduction to these Memoirs the author states that many of the most distinguished Japanese are fully aware of the advantage their country would derive from an extended intercourse with foreigners. In 1820 M. Abel Rémusat published in 8vo., from the MSS. of Titsingh, 'Mémoires et Anecdotes de la Dynastie régnante des Djogouns, souverains du Japon, avec la Déscription des Fêtes et Cérémonies observées aux différentes époques de l'année à la cour de ces Princes, et un Appendice contenant des Détails sur la Poësie des Japonais, leur Manière de diviser l'Année, &c.' An English translation of these two works, by Frederic Shoberl, was published in 1822. The volumes edited by M. Rémusat, and the English translation, contain a catalogue of the books, printed and in MS., the maps, plans, coins, &c., collected by Titsingh. Among the MSS. are his journal of travels from Canton to Pekin; copies of letters addressed by him to various persons during the years 1790 to 1797; forty-six autograph letters addressed to him by Japanese functionaries and Roman Catholic missionaries; thirty-five autograph letters addressed to him by Volney, De Guignes, senior, and other eminent literary characters; and an exposition of the official conduct of M. Titsingh. The publication of the most important of these documents is very desirable: they are calculated to throw light both on the character of the natives and the conduct of Europeans in these distant regions. The account of Titsingh's official conduct, and his journal while ambassador in China, might supply what is left untold by De Guignes and misstated by Van Braam in their respective publications. The twenty-fourth volume of the 'Annales des Voyages' contains an account of the island of Yesso, translated from the Japanese by Titsingh, and a 'Notice sur Japon,' in Charpentier Cossigny's 'Journey to Bengal,' contains a rather inaccurate report of the substance of conversations with him respecting that country. The important work the 'Japanese Encyclopædia,' in the 'Bibliothèque du Roi,' at Paris, was obtained from Titsingh.

(De Guignes, *Voyage à Peking*, &c.; *Memoirs*, by Titsingh, published at Paris, in 1819 and 1820; Van Braam's *Account of the Dutch Embassy to the Emperor of*

China; and a Notice of Titsingh, by Eyriès, in *Biographie Universelle.*)

TITTMANN, JOHANN AUGUST HEINRICH, one of the most distinguished German theologians of modern times, was born on the 1st of August, 1773, at Langensalza, where his father, Carl Christian Tittmann, was then preacher. Young Tittmann was originally of a very weakly constitution, but he gained strength as he grew older, especially from the time that he lived at Wittenberg, where his father was appointed præpositus and professor in the year 1775. His extraordinary talents enabled him to enter upon the study of theology and philosophy at Wittenberg as early as the year 1788, after he had the year before published a Latin essay, 'De Virgilio Homerum imitante,' Wittenberg, 1787. On completing his studies there, he went to Leipzig in 1792, where he began his career as academical teacher on the 15th of May, 1793. His talents and the extensive knowledge he possessed at this early age would have made him the first theologian of his time, if he had not been frequently drawn away from his regular studies, and occupied with different subjects. Nevertheless he distinguished himself so much, that in the year 1795 he was appointed morning-preacher (Frühprediger) to the university, and the year after professor extraordinary of philosophy, and in 1800 of theology. In 1805 he was made a doctor of divinity, and obtained the fourth ordinary professorship of theology, and in 1818 he became first professor of theology in the university of Leipzig. During the last years of his life he was dean of the cathedral of Meissen. He died, in consequence of a cold he took in 1828, and of which he never recovered, on the 31st of December, 1831.

As an academical teacher Tittmann distinguished himself by his acuteness, sound judgment, and by the simplicity and clearness with which he treated his subject. It was perhaps owing to the variety of subjects on which he had tried his strength, that in his later years he was found competent to undertake the most varied business in which he was employed by his government. At the congress of Vienna, which he attended for some time, he spoke with great frankness, and particularly exerted himself to realise his favourite plan of uniting the German Protestants, and giving to their body a new ecclesiastical constitution. But his object was not attained. During the last years of his life he was a member of the first chamber of the Saxon deputies, in which he represented the university of Leipzig, and often exercised great influence by his ability and his powers as a speaker.

The numerous writings of Tittmann are distinguished by great clearness of style, those written in German, as well as those in Latin. The following are the most important for the theological student:—'Encyclopädie der Theologischen Wissenschaften,' Leipzig, 1798, 8vo.; 'Theocles, ein Gespräch über den Glauben an Gott,' Leipzig, 1799, 8vo.; 'Ideen zu einer Apologie des Glaubens,' Leipzig, 1799, 8vo.; 'Theon, oder über unsere Hoffnungen nach dem Tode,' Leipzig, 1801; 'Lehrbuch der Homiletik,' Breslau, 1804, 8vo.; 'Pragmatische Geschichte der Theologie und Religion in der Protestantischen Kirche während der zweiten Hälfte des 18ten Jahrhunderts' (of this excellent work only the first volume appeared, Breslau, 1805, 8vo.); 'Ueber Supranaturalismus, Rationalismus, und Atheismus,' Leipzig, 1816, 8vo.; 'Ueber Vereinigung der Evangelischen Kirchen,' Leipzig, 1818; 'Die Evangelische Kirche im Jahre 1530 und 1830,' Leipzig, 1830, 8vo. Tittmann also edited the Greek text of the New Testament, Leipz., 1824, 12mo., which has often been reprinted, and Zonaras and Photius's Greek Lexicon, Leipzig, 1808, 4to.; but of this work only two volumes appeared, which contain the Lexicon of Zonaras. He also wrote a great number of Latin dissertations in programmes and on other occasions, which were edited after his death by Hahn, under the title, 'Opuscula varii Argumenti, maximam partem dogmatici, apologetici, et historici,' Leipzig, 1833, 8vo. Another Latin work, 'De Synonymis in Novo Testamento,' was edited by Becher, Leipzig, 1832, 8vo. Information about the author is given in the prefaces to these last-mentioned publications, and in the *Conversations Lexikon*, v. 'Tittmann.'

TITUS FLA'VIUS VESPASIA'NUS, the son of the emperor Vespasianus, was born on the 29th of December, 40 A.D. He received his education together with young Britannicus, who was poisoned by Nero in 55 A.D., and as Titus fell dangerously ill after the death of his unfortunate friend, it was said and believed that he had drunk a part of that deadly potion by which Britannicus perished. Titus afterwards erected two statues to the memory of the companion of his youth. Possessed of uncommon beauty and vigour, and extraordinary talents, Titus distinguished himself at an early age. The first campaigns which he made as tribunus militum were in Britannia and Germany. He first married Aricidia Tertulla, the daughter of a Roman knight, and after her death, Marcia Furnilla, who was of a noble family, but from whom he was divorced some time after she had borne him a daughter. Titus became afterwards quaestor. The Jews, having been oppressed by Gessius Florus, revolted in 66 A.D. and defeated Cestius Gallus, the proconsul of Syria, but they were beaten by M. Licinius Mucianus, the new proconsul of Syria, and T. Vespasianus, the father of Titus, who was the commander of the Roman army, which consisted of three legions. One of these legions was commanded by Titus, who showed as much military skill as personal courage, especially in the siege and capture of the towns of Taricheae and Gamala (67 A.D.). During his sojourn in Palestine he fell in love with Berenice, the daughter of Herod Agrippa. [BERENICE (6).]

In the mean time the emperor Nero was murdered, and Galba succeeded (69 A.D.). In consequence of this event, T. Vespasianus sent his son Titus to Rome, in order to gain the favour of the new emperor. Perhaps also Vespasianus wished to be informed of Galba's intention with regard to the war in Palestine, the command of the forces employed there being an office by which Vespasianus had acquired great influence in the East. (Tacitus, *Hist.*, ii. 1, and the notes to this passage in the edition of Gronovius, ii., p. 127.) The people said that Titus had some hope of being adopted by Galba, who was old and without issue; but although this motive of his going to Rome is rejected by Tacitus, the mere existence of such a rumour proves that Titus had already attracted the public attention. When Titus arrived at Corinth he was informed that Galba had been murdered (15th of January, 69 A.D.), and that the imperial power was disputed by Vitellius and Otho. This event perplexed him. His commission being to congratulate Galba, he could not expect to be well received by Vitellius, by whose instigation Galba had been massacred; nor did he deem it prudent to adhere to either of the imperial rivals before he had taken the advice of his father. He therefore returned to Judæa. There was a rumour that his love for Berenice was the secret cause of his return; but however strong his passion was, it never prevented him from doing his duty. On his way from Greece to Syria he landed on Cyprus, and there consulted the oracle in the temple of Venus of Paphos. The answer was favourable with regard to his voyage, and highly flattering to his ambition: Sostratus, the priest of the temple and reporter of the oracle, promised him the empire. (Tacitus, *Hist.*, ii. 2-4; Suetonius, *Titus*, c. 6.)

Titus was one of the leaders of the new revolution by which Vitellius lost his power a short time after his victory over his competitor Otho at Brixellum. Full of filial admiration for the character of his father, Titus endeavoured to remove the only obstacle to his accession, which might have frustrated their plans, notwithstanding Vespasianus was at the head of three legions and a strong body of auxiliaries. This obstacle was, a serious misunderstanding which existed between Vespasianus and Mucianus, the proconsul of Syria. Titus succeeded in reconciling them. Their difference had chiefly a political character, yet Titus, by the mildness of his manner and by the modesty of his persuasion, brought together two highly-gifted men who were divided by the most intractable of passions. Supported by Mucianus, by Tiberius Alexander, and by Titus, Vespasianus was proclaimed emperor by the army in the East, while his brother Flavius Sabinus occupied for him the Capitol in Rome, and compelled Vitellius to lay down the imperial diadem. [VESPASIANUS; TIBERIUS ALEXANDER; VITELLIUS.] Vespasianus left Judæa for Rome, and the command of the army of Judæa and the continuation of the war devolved upon Titus. Domitianus, the younger brother of Titus, having incurred the displeasure of his father, Titus interceded for him with brotherly affection. (Tacitus, *Hist.*, iv. 51, 52.)

The army in Judæa, of which Titus was now the commander, consisted of six legions, twenty cohorts of allies, eight corps of cavalry, the troops of the kings Agrippa and Sohemus, the auxiliaries of King Antiochus of Commagene, and a small body of Arabs. After a long siege, Jerusalem was taken by storm; the whole population, more than 600,000 men, was massacred; and the remainder of the Jews were dispersed over the world (2nd of September, 70 A.D.). [JERUSALEM.] In this memorable siege Titus distinguished himself both as a general and as a soldier, and it is said that he killed twelve men of the garrison with his own hand. In the same year Titus was created Cæsar by Vespasianus, whose colleague he was in his first consulship; and he was again consul in 72, 74, 75, 76, 77, and 79. Vespasianus however recalled his son from Judæa. A rumour was spread that Titus secretly aimed at making himself master of the East, and this rumour had reached Vespasianus.

So universally was Titus beloved, that the army implored him either to stay with them, or at least not to go without them; but he obeyed the command of his father, and by his speedy return proved that those rumours were entirely unfounded. He celebrated a triumph together with Vespasianus, for their victories over the Jews, in commemoration of which a triumphal arch was erected, which is still one of the finest monuments of that kind existing at Rome. Titus was likewise tribune with his father, who esteemed him so much, that he allowed him not only to write letters in his name, but also to draw up the imperial edicts. (Suetonius, *Titus*, 6.) During the reign of Vespasianus, various high functions were successively conferred upon Titus, whose character however seems to have been somewhat altered by the influence of the general corruption of the capital. He was charged with acting rashly; he subjected himself to the reproach of having ordered the murder of Caecina, which was an act of cruelty, for though Caecina was guilty of treason, he had not been legally sentenced (Suetonius, *Titus*, 6); and he was generally reproached for taking money from those who solicited his intercession with the emperor. On the other side however he remonstrated with his father on those measures which this very economical prince adopted for the purpose of improving the finances, which were exhausted by the dissipation of Vitellius. He was also charged with love of women. But he ordered Berenice, who had followed him to Rome, to go back to Judæa, and he thus proved once more that his passion for her did not prevent him from doing his duty. The consequence of all this was, that the Romans, who, by the example of Tiberius, Caligula, and Nero, knew that the virtue of exalted men is exposed to great temptations and strange changes, feared that Titus would become a new proof of the truth of their experience.

But no sooner did Titus become emperor by the death of Vespasianus, in 79 A.D., than he showed that all these fears were unfounded. His virtuous conduct was the subject of general admiration. During his short reign the empire was visited by great calamities. An eruption of Vesuvius destroyed the towns of Herculanum, Stabiae, and Pompeii, and carried ruin over the fertile coast of Campania (August 79 A.D.) [PLINY]; in 80 A.D. a conflagration broke out in Rome, which lasted three days, and destroyed a great part of this city; the buildings on the Campus Martius, the Capitol, the library of Octavianus, were laid in ruins, and the Pantheon was damaged [ROME]; and no sooner had the people recovered from their consternation than a plague broke out, of which 10,000 persons died every day. Titus supported his unhappy subjects with the greatest liberality; he exhausted his treasures, and he ordered the property and estates of those who had perished without leaving heirs, to be distributed among the sufferers, although the property of such persons belonged to the fiscus, or the emperor's private purse. His liberality was so great that his friends reproached him for it; he answered, that it was not just that anybody should leave the emperor with a sorrowful eye. He punished severely and exiled to the small barren islands in the Mediterranean those who followed the profession of false accusers [TIBERIUS CLAUDIUS NERO]; and he disliked the punishment of death so much, that he used to say he would rather die than cause the death of others. Two patricians conspired against him, but he did not punish them: he only said, 'Do not do it again; Providence alone distributes crowns' (Suetonius, *Titus*, 9); and he then invited them to accompany him to the amphitheatre. He acted with the same generosity towards his brother Domitianus, who was guilty of more than one conspiracy against his brother. He gained all hearts by his extreme affability, which however was always accompanied by dignity; and he delighted the Roman people with splendid entertainments, giving them amongst others the spectacle of five thousand wild beasts fighting with each other in the Colosseum, or Flavian amphitheatre, which was finished by his order, the construction of it having been commenced under Vespasianus.

During the reign of Titus, Agricola restored tranquillity to Britain, and penetrated as far as the Frith of Tay. (80 A.D.) In the following year he constructed the wall between the rivers Glota and Bodotria (the Frith of Clyde and the Frith of Forth), in order to protect Britain against the invasions of the Caledonians.

In order to recover his broken health Titus retired, in 81 A.D., to a villa in the neighbourhood of Reate, which belonged to his family, and where Vespasianus had died. Here he was attacked by acute fever, and died on the 13th of September, 81 A.D. It was said that his brother Domitianus, who had accompanied him to Reate, had been the cause of his death by advising the use of improper remedies. On his death-bed Titus exclaimed that he died without regret, except for one act, which however he did not specify. The news of his death reached Rome in the evening, and the senators assembled in the same night, anxious to know each other's hopes and fears with regard to the unworthy successor of Titus, Domitianus. The consternation of the people was general, for they had lost him to whom they had given the name of 'the delight of the human race.'

(Josephus, *Jewish War*, vi. 6, &c.; Dion Cassius, lxvi. 18, &c.; Aurelius Victor, *De Cæsaribus*, 10; Eutropius, vii. 14.)

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Coin of Titus.

British Museum. Actual Size. Copper. Weight, 398·7 grains.

TITUS, EPISTLE OF ST. PAUL TO. Little is known of the personal history of Titus, to whom this Epistle is addressed. His name is not even mentioned in the 'Acts of the Apostles,' and all authentic information about him is derived from the Epistles of St. Paul. From these it appears that Titus was converted by St. Paul, by whom he is called 'his own son after the common faith' (i. 4), but when and where is not recorded. Accordingly there are various conjectures on this subject. This we know for certain, that Titus was (*Acts*, xv.; *Gal.*, ii.) with St. Paul in Antioch before the first Council was holden at Jerusalem, and that he was one of the party sent by the church at Antioch to consult the Apostles at Jerusalem, on the question whether it was necessary for the Gentile converts to submit to circumcision 'after the manner of Moses.' To this rite the Judaising Christians at Jerusalem were anxious that Titus should submit; but St. Paul (*Gal.*, ii.) informs us that he firmly refused to do so. After the Council, it would seem that Titus returned with St. Paul to Antioch, and subsequently accompanied him on some of his travels.

At any rate, from the expression in 2 *Cor.*, viii. 23, it appears almost certain that Titus assisted St. Paul in preaching the Gospel at Corinth. From 1 *Cor.*, xvi. 8, compared with 2 *Cor.*, vii., it is not improbable that Titus was also with St. Paul during his long residence at Ephesus (*Acts*, xix. 10), and that he was selected to be the bearer of the first Epistle to the Corinthians, which was written by St. Paul at Ephesus. On his return from Corinth, whatever might be the occasion of the visit alluded to in 2 *Cor.*, vii., Titus met St. Paul in Macedonia, and gave him such an account of the Corinthian church, and of the effect produced by his first letter to it, as gave him the highest satisfaction. (2 *Cor.*, vii. 6-13.) Titus also appears to have been the bearer of the Apostle's second letter to the Corinthians, when he was charged to excite them to finish their collections for the poor converts in Judæa, which they had begun during his former visit. From A.D. 58, when we suppose him to have been the bearer of St. Paul's second epistle to the Corinthians, to A.D. 62, we hear nothing of him: in the latter year, in all probability he was left by St. Paul in Crete, 'to set in order the things that were wanting, and to ordain elders in every city.' (*Titus*, i. 4.) This year was the date of St. Paul's release from his first confinement at Rome, when he is supposed to have touched at Crete, and made some converts there, on his way from Italy to Judæa. Subsequently to this, Titus was requested by St. Paul (iii. 12) to visit him at Nicopolis in Epirus, and it seems that he was also with him during his second residence at Rome. (2 *Timothy*, iv. 10.) We have no certain information as to the time and place of Titus's death; but according to an antient tradition, he lived to the age of ninety-four years, and died and was buried in Crete. The date of the Epistle has been a subject of much controversy, some placing it as early as A.D. 52, and others as late as A.D. 65. From the striking verbal resemblances between it and the first epistle to Timothy, it is not improbable that they were written about the same time, and while the same ideas and phrases were present to the author's mind. The genuineness and authenticity of the Epistle have never been disputed.

St. Paul's design in writing it was to instruct Titus in the discharge of the duties of his ministry as head of the church in Crete. Accordingly in chap. i. he gives Titus instructions concerning the ordination of elders, who were to be appointed for every city, and describes what qualifications they should possess, and also directs him to oppose the Judaising teachers of Christianity, who seem to have been numerous in the island. In chap. ii. St. Paul informs Titus what precepts he was to inculcate, according to the age and circumstances of those whom he had to teach, and admonishes him to show himself a pattern of all good works, and an example of the doctrines which he taught.

In chap. iii. he teaches Titus to inculcate obedience to principalities and powers, in opposition to the Jews, who thought it an indignity to submit to idolatrous magistrates; and also that he should enforce gentleness and meekness towards all men. He then concludes with a request that Titus would inculcate the necessity of good works, and avoid foolish questions; an injunction of the same kind as St. Paul gave to Timothy.

For the undesigned coincidences between this Epistle and the 'Acts of the Apostles,' see Paley, 'Horæ Paulinæ,' pp. 357-367. See also Horne's 'Introduction to the Critical Study of the Scriptures,' vol. iv., p. 387; Macknight on the New Testament, vol. iii.; Collyer's 'Sacred Interpreter.'

TIT-WARBLERS, Mr. Swainson's name for a subgenus of his subfamily *Parianæ* [TITMICE], and considered by him as the second or typical division of the whole group. The species of this subgenus (*Sylvicola*) are, he observes, the true Tit-Warblers of America, so closely resembling the Worm-eaters (*Vermivora*, Sw.), that many writers have placed both in the same genus; but they may, he remarks, be readily detected by a slightly-arched bill, notched near the end of the upper mandible. 'The slender structure of their feet, the pointed form of their wings, and the scattered weak bristles of the mouth,' says Mr. Swainson in continuation, 'suggest the idea that the mode of catching their prey must not be unlike that adopted by the true flycatchers, and such accordingly turns out to be the fact; they are, in short, lively, active, gaily-coloured little birds, continually hunting after sedentary insects, and pursuing such as fly from bough to bough; their habits thus forming a singular union of those of the Wood-Warbler, the Tits, and the Flycatchers: so close indeed is this analogy, that Meyer has confounded them with the first, Linnæus and Buffon with the second, and even Wilson considers some as belonging to the third of these families. Nor was the great American ornithologist very far from the truth, since they actually pass into a subgenus which certainly would stand in the old Linnæan group of *Muscicapa*.' (*Classification of Birds.*)

The following is Mr. Swainson's definition of the subgenus *Sylvicola*, placed by him between *Dumecola* and *Vermivora*, under the genus *Sylvicola* (Fly-catching Warblers):—

Bill very slender, acutely conic; the tip of the upper mandible with an obsolete notch; base with a few weak bristles. Wings lengthened, pointed; the three first quills nearly equal. Tail nearly even; the feathers ending in soft points. Feet as in *Setophaga*.

Example, *Sylvicola minuta*.

Mr. Swainson refers, for a figure and description of this species, to 'Zool. Ill.,' i., pl. 139. At the place referred to we find the Grey-backed Warbler, *Sylvia plumbea*, with the following description and figure:—

Description.—Blue-grey, beneath golden yellow; back olive; wing-coverts tipped with white.

Mr. Swainson states that this bird is a native of Brazil, from whence it was received by Mr. Leadbeater.

Grey-backed Warbler. (Swainson.)

Mr. Swainson also refers to *Sylvicola pusilla*, Wil., pl. 38, f. 3.

TIVERTON, a borough and market-town in the hundred of the same name, is situated at the confluence of the rivers Exe and Loman, 169 miles south-west of London, and 14 miles north of Exeter. It derives its name (formerly Twyfordton, and now, by an easy gradual alteration, Tiverton) from its situation between the two antient fords, through the Exe on the west, and the Loman on the east. The hundred of Tiverton is described in 'Domesday Book' under the head of Terra Regis, or land belonging to the king, held by several persons during the reign of Edward the Confessor as vassals of the crown. Soon after the Norman invasion these lands were held by Baldwin de Brionis, who had married Albreda, the niece of William the Conqueror, and was created by him hereditary earl of Devon: they descended to his son, Richard de Brionis; and at his death, in 1100, without male issue, the manor and lordship were given by Henry I. to Richard Rivers, who was also created earl of Devon; and, in 1106, built Tiverton Castle for his residence. In 1293 the manor came into the possession of Hugh de Courtenay, second baron of Okehampton, created earl of Devon, in whose family it continued until 1466, when Henry Courtenay being attainted of treason, and beheaded on the 4th of March, his possessions were given to Sir Humphry Stafford, of Southwick, who was however also executed on the 17th of August following; and during the wars of the Roses and the succeeding convulsions the estates frequently changed owners, On the accession of Henry VII., in 1485, the house of Courtenay was again restored; and about the commencement of the sixteenth century William Courtenay married Catharine, seventh and youngest daughter of Edward IV., who survived him seventeen years, and lived during her widowhood in the castle of Tiverton: she was buried in the church adjoining. She was succeeded by her son and grandson, at whose death, in 1556, the lordship and manor were divided between the heirs of the four sisters of Edward, his great-grandfather; and soon after so subdivided, that when Risdon wrote, in 1630, there were then forty parts or shares, the principal of which came into possession of the Wests; and by the marriage of Dorothy, the heiress of that family, to Sir Thomas Carew, of Haccombe, in 1759, the family of Carew succeeded to the lordship and manor, which is now held by Sir Walter Palk Carew, Bart., together with the castle and adjoining estate, with a few other farms in fee, and different undivided eighths of many other lands in the parish.

Tiverton is supposed to be one of the largest boroughs in the kingdom, being about eleven miles in length, and nearly ten in breadth: the area is 20,000 acres, and it contains, according to the census of 1841, 1930 inhabited and 109 uninhabited houses; having a population of 10,041 inhabitants, 4648 males and 5393 females. The country on the west and north sides is very hilly and well wooded. The town is pleasantly situated on rising ground between the Exe and Loman, and is well watered by a brook called the Town Leat, which rises about 5 miles north of the town, and was given, about 1260, by the then countess of Devon, for the use of the inhabitants. On the west side of the river Exe is a large suburb called Westex, very densely populated, and principally inhabited by operatives. One of the greatest attractions of the town is the trout-fishing in the two rivers. On the east side of the town is the Tiverton branch of the Great Western Canal, by which limestone, coal, culm, coke, &c. are imported.

The parish church, or at least part of it, was first built in 1073; consecrated by Leofricus, first bishop of Exeter; and enlarged and improved at various times by the families of Rivers and Courtenay previous to the fifteenth century. Between 1517 and 1529 John Greenway, an eminent merchant, rebuilt and enlarged the whole of the south aisle and south front, together with the elegant chapel bearing his name; and also erected the fine Gothic screen which separates the chancel from the body of the church. The south front and porch (of which an engraving appeared in the 'Gentleman's Magazine'), together with Greenway's Chapel, have lately been rebuilt, and the whole of the church new seated. It is a fine Gothic pile, 136 feet long and 82 feet wide; and the tower is 27 feet square at the base and 116 feet high. St. George's Chapel, which was finished in 1730, is of the Doric order, and situated in a large yard in the centre of the town. The tithes of the whole parish were granted, in 1146, by Baldwin de Rivers to the Cluniac monks at Exeter; but the parish was afterwards divided; for in 1257, as appears by the episcopal registers at Exeter, there were, as at present, four quarters, or ecclesiastical portions, viz., three rectories (Clare, Pitt, and Tidcombe), and an impropriation (Priors), which Henry VI. gave to the provost and fellows of King's College, Cambridge, who still retain the tithes, and appoint a stipendiary curate to perform a fourth part of the duty, although they deny their liability to do so. The tithes have lately been commuted: Clare at 565*l.*; Pitt, 850*l.*; Tidcombe, 731*l.* 10*s.*; Priors, 400*l.*; and certain small detached pieces of land, technically called 'All Fours,' 66*l.*

There are still many richly-endowed charities in Tiverton. Blundell's free grammar-school was founded by Peter Blundell, merchant, in 1599: the income has increased, owing to the rise in the value of land, from under 100*l.* to about 1200*l.* per annum. There is now a surplus income of 500*l.* or 600*l.* a year. There are several fellowships, scholarships, and exhibitions connected with this school at Cambridge and Oxford. There is also a free English school, founded in 1609 by Robert Comyn, alias Chilcott, the nephew of Blundell. A blue-coat or charity school, where a number of poor children of both sexes are educated and clothed, has lately been erected in lieu of an old building, and it is supported by various bequests. There is also a national school, just built, which is supported by voluntary contributions; and an elegant school is now being erected in Westex, to be put under the direction of the British and Foreign School Society. Among the miscellaneous charities are Greenway's almshouses, founded in 1517, for the support of five poor men, with eightpence weekly for each; but the revenues are now so much augmented that there are eleven houses the inmates of which receive five shillings per week each, and ten of which the inmates have four shillings, and four additional almshouses are now being built. There is also an excellent charity, founded by Walter Tyrrel in 1568, the proceeds of which are employed in repairing Exe bridge, and the overplus distributed weekly in bread. There are many others of less importance; and it has been said that if all the charitable donations had been properly looked after, there would not at present be any need of a poor-rate.

The woollen trade of Tiverton was formerly very extensive. From 1560 to 1566 there were only 2500 inhabitants, whereas in 1591 the population had increased to 5000; and Dunsford states, on the authority of Risdon and Chapple, that it was the principal place in Devonshire for the making of kersies, which were known all over the kingdom as 'Tiverton Kerzies,' and generally sent to the London market. In 1612, 8000 persons were constantly employed in the manufacture of woollen cloth, and the annual returns of the trade exceeded 300,000*l.*; but an extensive fire shortly afterwards destroyed property to the amount of a quarter of a million, the operatives were dispersed over the country, and the town never recovered its former prosperity. After this the trade in kersies gradually declined; but in 1690 the manufacture of mixed worsted serges was established, and by 1715 there was again a population of 8700, with a trade returning 350,000*l.* annually. In 1741 an epidemic fever scattered the population, and as serges were supplanted in Holland by the Norwich stuffs, the manufacturers engaged in making common duroys, &c., for the Spanish and Italian markets. In 1756 there were 56 fulling-mills regularly employed, but the French revolution, and the long wars consequent upon it, put an end to the foreign trade, and the improvement of machinery in Yorkshire has taken away the woollen manufacture. In 1790 however a large building was erected in Westex for a cotton-mill, but finally converted into a manufactory for spinning wool, which was afterwards woven into coarse fabrics for the East India Company. This undertaking did not answer, and it was shut up in 1815. In 1816 Mr. Heathcoat of Loughborough, in consequence of the Luddite disturbances in that neighbourhood, removed to it with his beautiful machinery for making bobbin-net, for which he had obtained a patent in 1808, and many successive improvements having been made on it, the trade is still carried on to the great benefit of the town. It gives permanent employment to above 900 persons, besides temporary employment to several hundred girls and women.

The venerable remains of the old castle of the Riverses and Courtenays stand on an eminence near the Exe; some parts of the building are still in pretty good preservation, and might with a little repair last for several ages, but a considerable part of it was pulled down about a century since, and a modern house erected on its site. There is also a spacious market-place, erected in 1830, with a suite of rooms for assemblies, several dissenting chapels, a theatre, union workhouse, and bridewell, which is about to be pulled down, and a building on an improved plan erected in lieu of it.

Soon after the fire of 1612, James I. incorporated Tiverton by the title of mayor and burgesses, but the elective franchise then conferred was confined to the corporate body (25 in number), and continued in that state until the passing of the Reform Bill in 1832, under which the constituency is about 500. The castle was bombarded and taken by General Fairfax in 1645, when Sir Gilbert Talbot was the governor.

Cosway the painter was a native of Tiverton, and painted an altar-piece of 'Peter delivered out of Prison,' which he presented to the parish, and it was placed in the church in 1777; the celebrated Bampfylde Moore Carew, the gipsy king, who lived a century ago, was a son of the rector of Bickleigh, an adjoining parish, and ran away from Blundell's school to join the gipsies. Although nearly related to the most respectable families of the western counties, nothing could induce him to give up his connection with this singular people, and his adventures, dictated by him to Mrs. Goadby of Sherborne, and which have been very frequently republished, contain an amusing account of his vagabondism.

The principal market is on Tuesday, and is very abundantly supplied with live cattle, corn, meat, poultry, vegetables, and fruit; there is another smaller market on Saturdays, and two fairs. There is an anniversary meeting of the trustees and other gentlemen educated at the grammar-school about the last week in August, and on the two following days there are races over a very excellent course, in the castle meadows adjoining the town. The borough is divided into three wards: Westex ward, Castle ward, and Loman ward, and the municipal body consists of six aldermen and eighteen councillors, out of whom the mayor is chosen; the recorder is, as in other cases, nominated by the crown; he holds a session four times a year, and is the judge of the court of record for debts under 100*l*. The town is well lighted with gas, and the streets are under the control of commissioners empowered by act of parliament, who keep them very clean. (*Communication from Tiverton.*)

TIVOLI, the antient *Tibur*, a town of the Papal State, 16 miles east-north-east of Rome, situated on the slope of a hill on the left bank of the Anio, or Teverone, just above the spot where that river falls by a succession of rapids into the lowlands of the Campagna. Tibur existed as a town before the building of Rome, and its origin is lost in the obscurity of fabulous times. Virgil, in relating the wars of the Latins and Rutuli against Æneas, speaks repeatedly of Tibur. According to the old tradition, Tiburtus, son of Catillus, who emigrated from Greece with Evander to the shore of Latium previous to the Trojan war, founded or colonized Tibur. Coras and Catillus the younger, two brothers of Tiburtus, fought against Æneas and his Trojan followers:

> 'Tum gemini fratres Tiburtia mœnia linquunt,
> Fratris Tiburti dictam cognomine gentem,
> Catillusque acerque Coras, Argiva juventus.'
> *Æneid*, vii.

Pliny (*Hist. Nat.*, xvi. 87) mentions three old oak-trees, existing in his time, which were reported to be older than Tiburtus, the founder of Tibur, and were consecrated to him. According to a passage in Horace (*Od.*, i. 7), they were called 'Tiburni lucus.' In the same passage Horace, as well as Virgil in the seventh book of the *Æneid*, speaks of the fane and grove of the Sibyl Albunea at Tibur, the oracles of which were consulted from the oldest times.

In the early part of the history of Rome we find Tibur mentioned as one of the principal towns of the Latin Confederation. It stood where it still stands, on the left bank of the Anio, which river divided the territory of the Latini from that of the Sabini, and it was strong by its situation between the mountain and the river. [LATIUM.] The subsequent vicissitudes of Tibur and the other Latin cities, till their final subjection by Rome, 337 B.C., are noticed under LATINI. Upon one occasion the militia of Tibur joined the Gauls and marched during the night to the walls of Rome, and spread alarm into the city, but they were repulsed. (Livy, vii. 12.) After the final defeat of the Latins, Tibur was deprived of part of its territory, which was seized by the Romans. During the Samnite wars the Romans made a road from Tibur over the Apennines to the country of the Peligni, which was called Via Valeria. The aqueducts of the Anio vetus and Anio novus, and of the Aqua Marcia, which supplied Rome with wholesome water, passed through the territory of Tibur, where their remains are still seen. The healthy and romantic situation of this district induced the wealthy Romans to construct in it handsome country residences. Scipio Æmilianus, Metellus Numidicus, the famous Marius, Mæcenas, Munatius Plancus, and Manlius Vopiscus, had their Tiburtine villas. The families of the Munatii, the Coponii, and the Plautii, which flourished at Rome in the latter times of the republic and under the first emperors, were from Tibur. The mausoleum of the Plautii is still seen at Ponte Lucano, a few miles from the town on the road to Rome. It is in the shape of a massive round tower, like that of Cæcilia Metella outside of Rome, with an inscription, which however is said to be of much later date, to M. Plautius Silvanus, who served under Tiberius in the Illyrian war (A.D. 10). G. M. Zappi, who lived about the middle of the 15th century, describes, in his 'Annals of Tivoli,' this monument, as it then was, in better preservation than at present.

Augustus used to visit his favourite Mæcenas at his villa at Tibur, and Suetonius (*Octav.*, 72) mentions his holding his tribunal under the porticoes of the splendid temple of Hercules, part of the cella of which is still seen behind the choir of the modern cathedral, which has been partly constructed with the materials of the antient temple. Gellius (xix. 5) mentions a public library as annexed to the temple. Horace preferred Tibur to all other places of resort, and he had a country-house in the neighbourhood, distinct from his Sabine farm at Digentia.

The emperor Hadrian constructed near Tibur a magnificent villa, of which extensive remains are still seen. It contained imitations of the works of art and of the beauties of nature which he had seen in his travels throughout the empire. Under his reign Getulius, a native of Tibur, and his wife Simphorosa, with their seven sons, being converts to the Christian doctrine, are said to have suffered martyrdom, according to Baronius, Tillemont, and other church historians. Under Aurelian, the famous Zenobia, queen of Palmyra, after having followed the triumphal procession of her conqueror, was by order of the senate banished to Tibur, where she is said to have lived many years in comparative comfort. The grammarian Nonius Marcellus, who belongs to the fourth century, was a native of Tibur.

In the year 543 the Goths under Totila took Tibur by surprise, and slaughtered most of the inhabitants, including the bishop. During the Longobard dominion in Italy, Tibur was included in the duchy of Rome, subject, at least nominally, to the emperors of Constantinople, and afterwards to Charlemagne and his successors. After the fall of the Carlovingian dynasty, and while the crown of Italy was an object of contest between various pretenders, Tibur, like most other towns of central Italy, governed itself as a municipal community. Its territory, which extended to the westward about half-way between Tibur and Rome, embraced in the opposite direction the whole valley of the Anio as far as the borders of Naples. But the abbot of the wealthy Benedictine monastery of Sublaqueum, now called Subiaco, having assumed the civil jurisdiction over extensive domains, villages, and castles in the upper part of the valley and the adjoining highlands, of which he had already, by various grants, the 'utile dominium,' the municipality of Tibur, together with the bishop, resented his usurpation. After a temporary compromise between the parties, effected through the mediation of the pope, the Tiburtines resorted to arms, about A.D. 1123, took several castles, from which they drove away the monks and their men-at-arms, and a sort of desultory warfare was carried on for several years, until 1128, when the abbot of Sublaqueum surprised the castle and village of Poggio, which was colonized by the Tiburtines; and after a desperate fighting in the streets and houses, the place was plundered and destroyed. After this a truce was concluded between Tibur and the abbot. In 1141, during the schism between Innocent II. and the anti-pope Anacletus, the Tiburtines having acknowledged the latter, the people of Rome, who had had frequent border quarrels with their Tiburtine neighbours, seized this opportunity to assail their town with a considerable force. While they were trying to break open one of the gates, the inhabitants turned off part of the waters of the Anio, and made them fall with overwhelming force down the declivity upon the assailants, part of whom were swept away; and the citizens, sallying out at the same time, routed the remainder of the besiegers, who ran away, leaving behind their tents and baggage. This was the cause of that deadly animosity of the Romans against the Tiburtines, which continued for more than a century after. In the following year, 1142, the people of Tibur, being threatened with another attack, thought it prudent to make their peace with Pope Innocent, and they swore allegiance to him, which so incensed the Romans, who were bent upon the destruction of Tibur, that they rose in arms against the pope, restored the senate, and proclaimed the republic. In 1145 Pope Eugenius III. took refuge at Tibur from the turbulence of the Roman people. During the subsequent dissensions between the emperor Frederic I. and the pope, the people of Tibur seem to have remained faithful to the latter, and they joined the Roman militia in an attack upon Tusculum, the inhabitants of which had taken the part of the emperor, which ended in the total destruction of that antient city, A.D. 1191. The Tiburtines obtained a large share of the plunder of Tusculum. Frederic II., in his wars against the pope, held for a time possession of Tibur. After a course of desultory warfare between Rome and Tibur, a treaty was concluded and signed by the magistrates of both towns, in August, 1259, entitled 'Capitula et Instrumenta inter Romanum Populum et Populum Tiburtinum,' by which the city of Rome secured the right of sending to Tibur a count, rector, or podestà, as political magistrate, who however, before entering upon his office, was to swear to observe the municipal statutes of the town of Tibur; but the judges, the captain of the militia, and the councillors of the commune, continued to be chosen by the citizens of Tibur as heretofore. The town of Tibur was to pay to the senate of Rome an annual tribute of one thousand 'libre' (about two hundred dollars). After this the people of Tibur, though often distracted by the factions of the Guelphs and the Guibelines, the Colonna and the Orsini, which desolated for more than a century the Campagna and the neighbouring districts, remained upon the whole attached to the popes; and they even fought for Urban VI. against the Orsini lords of Vicovaro and Tagliacozzo, whom they defeated in 1381. Pope Pius II. built a castle at Tivoli, which remains.

Tivoli is now the head of a district of the comarca or province of Rome, which district, according to the last census, contained 55,825 inhabitants, and includes most of the old territory of Tibur. It is one of the few antient towns of Latium which stands on its antient site; whilst the modern representatives of Tusculum, Præneste, and Alba are no longer on the spot of those antient cities. The temple of Vesta, vulgarly called 'Della Sibilla,' with its Corinthian pillars, still occupies its commanding position; the temple of Hercules has been transformed into a cathedral; the Roman road, or Via Tiburtina, crosses the town; the Roman bridge called Ponte Celio, or Ponticelli, is still extant. There are considerable remains of the Villa of Mæcenas near the Cascatelle. Remains of that of Quintilius Varus are shown near a church called Quintiliolo. Another round temple, vulgarly styled 'Della Tosse,' or of the goddess Tussis, is outside of the Roman gate.

Tivoli is a bishop's see: it has a college, and a town library of about 6000 volumes, the gift of the Cavaliere Bischi, a native of the place; several manufactories of iron, leather, and paper; and 5300 inhabitants. The surrounding hills are covered with olive-trees. The streets of the town are narrow and steep. Near Tivoli is the extensive Villa d'Este, constructed about the middle of the sixteenth century by the Cardinal Ippolito the younger, of Este, son of Alfonso I., duke of Ferrara, who was governor of Tivoli under Pope Julius III., and afterwards embellished by the Cardinal Luigi d'Este, brother of Alfonso II. It has all the formal magnificence of the gardens and pleasure-grounds of that age; its trees cut in architectural shapes, its mosaic-like parterres, its handsome fountains and water-works, constructed by Orazio Olivieri, a celebrated hydraulist of Tivoli; its avenue of Italian pines, and its terraces,—constitute a princely residence, suited to the character and style of its former owners. The mansion is adorned with frescoes by Zuccari and Muziano. The view from the terrace before the house is magnificent. Venturini has published views of this villa, 'Fontane del Giardino Estense coi loro prospetti.' The country about Tivoli and the valley of the Anio above it is one of the most pleasant, salubrious, and romantic districts near Rome. Vicovaro, the antient Varia, eight miles above Tivoli; the secluded monastery of Subiaco, which is twelve miles above Vicovaro, near where Nero had a villa; the sources of the Anio, near Trevi, above Subiaco; and the valley of Digentia, afford scope for interesting excursions. The vines of Tivoli are famed for a peculiar sort of grape, called 'pizzutello' and 'pergolese,' which, on account of its firmness and luscious taste, is much in request for the table. It was noticed as early as the time of Pliny the elder, who says (*Hist. Nat.*, xiv. 4, Tauchnitz edit.) that it was then a newly discovered sort of grape, having the appearance of the olive, and was called by the Tiburtines 'uva municipi.' The stone commonly called 'travertino,' of which many of the buildings of Rome are built, is dug near Tivoli.

Many authors have written concerning the history and antiquities of Tivoli. Nicodemi wrote its history in Latin; Zappi wrote 'Annali di Tivoli;' Del Ré, 'Antichitá Tiburtine;' Marzi, 'Storie Tiburtine;' Cabral and Del Ré, 'Nuove Ricerche delle Ville e dei più notabili Monumenti antichi della Città e del Territorio di Tivoli,' an excellent guide-book; De Sanctis, 'Dissertazioni sopra la Villa d'Orazio, sopra il Mausoleo de' Plauzj, e sopra Antino;' Ligorio, 'Pianta della Villa Tiburtina di Adriano disegnata e descritta,' published by F. Contini, fol., Rome, 1751; Agostino Capello, 'Saggio sulla Topografia Fisica di Tivoli,' in the 23rd vol. of the 'Giornale Arcadico,' 1824; Volpi, 'De Tiburtibus, seu Tiburtinis,' in his 'Vetus Latium;' and lastly, Viola, 'Storia di Tivoli della sua origine fino al Secolo XVII.' Rome, 1819.

TLASCALA. [MEXICAN STATES, vol. xv., p. 159.]

TMOLUS (Τμῶλος), a chain of mountains which runs from east to west, nearly through the centre of Lydia, and parallel to the Messogis. It detaches itself from the Messogis near the borders of Phrygia and terminates on the coast opposite the island of Chios. It thus separates the valley of the Caystrus from that of the Hermus. It is said by Pliny to have been previously called Timolus. (*Nat. Hist.*, v. 30; compare Ovid, *Met.*, vi. 15; xi. 86.)

Tmolus was celebrated in antiquity for its wine (Strabo, xiv. 637), to which allusion is frequently made in the 'Bacchæ' of Euripides. It was also rich in minerals; and the Pactolus, which flows from it into the Hermus, is said to have washed down a great quantity of gold, whence Crœsus and the Lydian kings were supposed to have obtained a great part of their wealth. In the time of Strabo however no gold was found in the river. (Herod., i. 93; v. 101; Strabo, xiii. 626.) Chishull, who visited Tmolus in 1699, describes the mountain as pleasant, and garnished with an infinite variety of plants, shrubs, and trees. Besides a fine prospect of the country, the traveller is amused with impending rocks, perpendicular precipices, and the murmurs of a brook, probably the Pactolus. On the top, which he gained in four hours, was a fruitful vale between two lofty ridges; with a vein of marble as clear and pellucid as alabaster. (Chandler, *Travels in Asia Minor*, c. 77.) Mr. Fellowes (*Account of Discoveries in Lycia*, p. 8) speaks of the mountain being covered with snow at the latter end of February; but Chishull found the snow remaining on the summits at the latter end of April.

In the time of Strabo there was a watch-tower of white stone on the top of Tmolus, which had been built by the Persians, and from which the whole of the surrounding country could be seen, especially the plain of the Caystrus. (Strabo, xiii. 625.) Tacitus (*Annal.*, ii. 47) speaks of a town Tmolus, which was destroyed by an earthquake in the reign of Tiberius, A.D. 17. This town seems to have been situated either upon or near the mountain. Ernesti, in his note upon the above-mentioned passage of Tacitus, says that this town is also mentioned by Herodotus (i. 84), but Herodotus is speaking of the mountain, not of the town. The Mesotimolitæ, as the name indicates, inhabited the central part of the mountain. (Pliny, *Nat. Hist.*, v. 30.)

TOAD. [FROGS.] MM. Duméril and Bibron (*Erpétologie*) make the Bufoniform family of the Anurous Phanerogloss Batrachians (*Anoures Phanéroglosses*) consist of the following genera:—

Dendrobates, Wagl. (*Hylaplesia*, part, Boie, Tschudi.)
Example, *Dendrobates tinctorius* (Cayenne).
Rhinoderma, Dum. and Bibr.
Example, *Rhinoderma Darwinii* (Chili).
Atelopus, Dum. and Bibr.
Example, *Atelopus flavescens* (Cayenne)
Bufo, Laur.
Example, *Bufo vulgaris*, the common toad. (Europe, Japan.) [FROGS, vol. x., pp. 490, 491, 493, 495.] MM. Duméril and Bibron record eighteen species of this genus.
Phryniscus, Wieg. (*Chaunus*,* part, Tschudi.)
Example, *Phryniscus nigricans*, Wieg. (Montevideo.)
Brachycephalus, Fitzing. (*Ephippifer*, Coct.)
Example, *Brachycephalus ephippium*, Fitzing. (Brazil, Guyana.)
Hylædactylus, Tschud.
Example, *Hylædactylus baleatus* (Java).
Plectropus, Dum. and Bibr.
Example, *Plectropus pictus* (Manilla).
Engystoma, Fitzing. (*Microps*, Wagl.; *Stenocephalus*, Tschud.)
Example, *Engystoma ovale* (Surinam, Buenos Ayres).
Uperodon, Dum. and Bibr.
Example, *Uperodon marmoratus* (Montavalle, Indian Peninsula).
Breviceps, Merrem (*Engystoma*, part, Fitzing.; *Systoma*, Wagl., Tschud.).
Example, *Breviceps gibbosus* (South Africa, near the Cape of Good Hope).
Rhinophrynus, Dum. and Bibr.
Example, *Rhinophrynus dorsalis* (Mexico).

Geographical Distribution of the Family.—MM. Duméril and Bibron state (*loc. cit.*) that the number of species known to them (1841) was thirty-five, a much less number than that of the Raniform family, which includes fifty-one, and less still than the Hyliform or Tree-frog family, which comprises sixty-four.

Nevertheless, observe these excellent herpetologists, species of this family exist in all the five* parts of the world, where they are distributed in a manner not less unequal than the Raniform and Hyliform species, and, always, with a greater proportion for America, whilst the smallest portion of them belong to Europe, which has not even a single species peculiar to itself, for the two† there found, the Common Toad and the Green Toad (*Bufo viridis*, Laur.), also inhabit Africa and Asia, which produce moreover, the one *Bufo pantherinus* and *Breviceps gibbosus*, the other *Plectropus pictus*, *Engystoma ornatum*, *Hylædactylus baleatus*, *Uperodon marmoratum*, and *Bufones cruentatus*, *scaber*, *biporcatus*, *isos*, and *asper*.

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* N.B. Præoccupied, at least *Chauna* is in ornithology. [PALAMEDEA, vol. xvii., p. 155.]

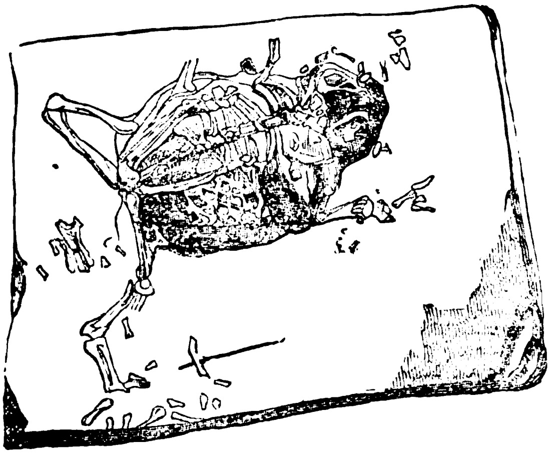
Oceania, which, after America, is, they observe, best furnished with Hyliform species, and where two of the Raniform family are found, has not hitherto yielded more than a single Bufoniform species, viz. *Phryniscus Australis*.

America, besides six species of *Bufo*, viz. *strumosus*, *melanotis*, *musicus*, *Americanus*, *margaritifer*, *d'Orbignyi*, and *Leschenaultii*, furnishes *Dendrobates tinctorius*, *obscurus*, and *pictus*; *Rhinoderma Darwinii*; *Atelopus flavescens*; *Phryniscus nigricans*; *Brachycephalus ephippium*; and *Engystomata ovale*, *Carolinense*, *rugosum*, and *microps*.

Mr. Darwin, speaking of the Fauna of the Galapagos Archipelago, says, 'Of snakes there are several species, but all harmless. Of toads and frogs there are none. I was surprised at this, considering how well the temperate and damp woods in the elevated parts appeared adapted to their habits. It recalled to my mind the singular statement made by Bory St. Vincent, namely, that none of this family are to be found on the volcanic islands in the great oceans. There certainly appears to be some foundation for this observation; which is the more remarkable, when compared with the case of lizards, which are generally among the earliest colonists of the smallest islet. It may be asked whether this is not owing to the different facilities of transport through salt-water, of the eggs of the latter, protected by a calcareous coat, and of the slimy spawn of the former.' (*Journal.*)

FOSSIL TOADS.

Here may be noticed the fossil specimens from the Œningen beds—*Bombinator Œningensis*, Agass. (*Pelophilus Agassizii*, Tschudi), and *Palæophrynos Gessneri*, Tschudi. (See *Classification der Batrachier*, von J. J. Tschudi, pp. 84, 89, tab. 1, ff. 2, 3.)



Palæophrynos Gessneri. (Tschudi.)

TOALDO, GIUSEPPE, a celebrated Italian geographer and meteorologist, was born in 1719 at a small village near Vicenza. After having received the usual rudiments of education, he was sent to the University of Padua, in order to qualify himself for the priesthood by the study of literature and theology; and while there, a taste for natural philosophy, and particularly for astronomy, induced him to devote a considerable portion of his time to the pursuit of those branches of science; this pursuit he continued, during the intervals which his pastoral duties afforded, after he had quitted the university and become the curate of a village in the neighbourhood.

In 1762 he was appointed professor of physical geography and astronomy in the same university, and he immediately availed himself of the influence which his appointment gave him to obtain the grant of a building which might be occupied as an observatory; in this he succeeded, and being allowed the use of an antient tower, he placed in it all the instruments which he could collect. In this building he made a series of astronomical observations, in continuation of those which had been made about forty years previously by Poleni; and the first thunder-rod erected in the Venetian states was one which Toaldo applied to the same building.

He died suddenly at Padua, in December, 1798, in consequence of a fit of apoplexy, which was supposed to have been brought on by a domestic calamity.

The Abbé Toaldo applied himself to the study of mathematics only as far as that branch of science is applicable to geography. In 1769 he published at Padua a treatise on plane and spherical trigonometry, with a collection of tables; and at Venice, in 1773, a tract entitled 'Compendio della Sfera e di Geographia.' In 1782 he published his 'Saggio di Studi Veneti nell' Astronomia e nella Marina;' and two years afterwards, his method of finding the longitude of a place by an observed transit of the moon; in 1789 appeared his 'Trattato di Gnomonica,' and in 1791 a work entitled 'Schediasmata Astronomica.'

In 1776 he gave, in a letter to Mr. Strange, the British resident at Venice, an account of the tides in the Adriatic, which he drew from the observations of Signior Temanza, an Italian architect and engineer. From this account it appears that the tides in that sea are at their greatest height in winter; that the height of the spring-tides amounts to between 3 and 4 feet, while the neap-tides scarcely exceed 3 inches. (*Phil. Trans.*, vol. lxvii.)

The attention of Toaldo was strongly directed to meteorology at a time when this branch of natural philosophy was but little studied; and he is the first who took notice of the supposed connexion of atmospherical phenomena with the movement of the moon in her orbit. Having observed that those phenomena return in nearly the same order at the end of every eighteen years, he drew up tables exhibiting the state of the weather during three such periods; and an account of his system was given in a paper entitled 'Le Saros Météorologique,' &c., which is contained in the 'Journal de Rosier' for 1782.

In 1770 Toaldo published a tract entitled 'Saggio Meteorologico sulla vera Influenza degli Astri;' and two years afterwards, a tract concerning the method of protecting buildings from the effects of lightning; he also published, in 1775, a work on the application of meteorology to agriculture.

Toaldo wrote a life of the Abbé Conti, which was prefixed to an edition of the works of that philosopher and poet, who had been his instructor.

TOBACCO, the common name of the plants belonging to the Monopetalous genus *Nicotiana*. Tobacco was the name used by the Caribbees for the pipe in which they smoked, but this word was transferred by the Spaniards to the herb itself. The genus Nicotiana contains about forty species, most of them yielding tobacco for smoking, and many of them cultivated in the gardens of Europe. The name Nicotiana was given these plants after Jean Nicot, of Nismes, in Languedoc, who was an agent of the king of France at Portugal, and there procured the seeds of the tobacco from a Dutchman who had procured them in Florida. Nicot sent them to France in 1560.

The species of Nicotiana are most of them herbs, rarely undershrubs, and generally clothed with clammy hairs or down. The flowers are terminal, racemose or panicled, and of a white, green, or purplish colour. The calyx is 5-cleft, permanent; corolla funnel- or salver-shaped, divisions 5, plicate and spreading; stamens 5, as long as the tube of the corolla; anthers dehiscing lengthwise; stigma capitate; capsule 2-celled, 2-valved, valves bipartite; seeds minute, numerous.

N. Tabacum, Common Virginian or Sweet-scented Tobacco, is an herbaceous plant, with acuminated, oblong, lanceolate, sessile leaves, lower ones decurrent; throat of

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* The fifth part is that termed by the French 'Océanie,' which includes the Indian Archipelago, the Society, Friendly, and other isles, Australia, and Van Diemen's Land

† N B *Bufo calamita*, Laur., recorded as a third species by the Prince of Canino (*Fauna Italica* and *Amphibia Europæa*), is considered by MM. Duméril and Bibron as identical with *Bufo viridis*.

corolla inflated, segments of the limb pointed. This plant is a native of the West Indies, where it first became known to the Spaniards, and of Virginia, where the English first became acquainted with its properties. Of the various species it is that which is most commonly cultivated in gardens as an ornament. It is also largely cultivated in Europe for the purpose of smoking. The other species are however in some cases preferred. Schrank has described a large number of varieties of the common tobacco, varying in the size and form of their leaves, as well as the colour and form of their corollas. For an account of the properties of this species, see NICOTIANA TABACUM.

N. Macrophylla, Orinoco Tobacco, is an herbaceous plant, with ovate acute leaves clasping the stem; throat of corolla inflated, segments short, pointed. It is a larger plant than the last, the stem rising from five to seven feet high. It is a native of America, and is frequently used for smoking, under the name Orinoco tobacco; it is however inferior to the last; the milder Havannah cigars are said to be made from it.

N. Rustica, English Tobacco, has an herbaceous square stem, with petiolate ovate, quite entire leaves, tube of corolla cylindrical, longer than the calyx; segments of the limbs roundish, obtuse. This plant is a native of Europe, Asia, Africa, and America. It is called English tobacco because it was the first species that was introduced into this country for growth; it was then brought from America. It grows very well in this climate, and in some places is almost naturalised. It is known in France as *tabac pausse*, in Germany as *Bauern-tabak*, and in Spain as *Tabacca cimarosa*. This plant grows on the coast of the Mediterranean, and thence finds its way into India, where it is highly valued. The tobaccos of Salonica and Latakkia, which are much esteemed, appear to be the produce of N. rustica. From the extensive range of climate and difference of situation which this plant occupies, its characters suffer considerable change; hence a number of varieties have been described. In the shops this tobacco is known as Turkish.

N. Persica, Shiraz Tobacco, is an herbaceous plant, clothed with clammy down, with the leaves of the root oblong, those of the stem acuminate and sessile; corolla salver-shaped, with a long tube, and rather unequal segments. This plant is a native of Persia, and furnishes the famous Shiraz tobacco. This tobacco is milder than that produced by the *N. tabacum*, and but a small quantity is consumed in this country. The English smoke more of the strongest tobacco than any nation in the world.

There are several other species of tobacco which are used in the places where they naturally grow for smoking. *N. quadrivalvis* has capsules with four valves; it grows on the Missouri river, and is there smoked by the natives. *N. multivalvis* has capsules with many valves; it is cultivated by the Indians on the Columbia river for smoking. It is a fetid plant, and the calyx, the most fetid part, is selected by the Indians for smoking. *N. nana*, a small species of tobacco, is a native among the Rocky Mountains of North America, and is smoked by Indians. *N. repanda* is a native of Cuba, and is said to furnish the tobacco for making the small cigars known as Queen's.

Cultivation.—The cultivation of tobacco is most extensively carried on in the United States of North America. It requires considerable heat to come to perfection; but with care and attention, and by treating it as an exotic, it may be very successfully cultivated in much colder climates. The least frost injures it; but this is the case with many plants, which are nevertheless successfully cultivated in the northern part of Europe. The seeds of the tobacco plant must be sown in a prepared seed-bed, and be carefully protected from the least frost: for which purpose straw and fern are used, as is done by the market-gardeners who raise early culinary vegetables. When once the danger of spring frosts is over, they may be safely transplanted; and if the ground has been duly prepared, they will arrive at maturity before the frosts of autumn, as is the case with potatoes, buckwheat, and many other plants which are natives of warmer climates. To accelerate the growth of the tobacco plant the ground should have been deeply trenched, and highly impregnated with manure for some time before; for fresh dung, especially that of horses, would impart a rank disagreeable flavour to the leaf. It is therefore by a preparatory course of high cultivation, and by bringing the soil to the state of a rich garden mould, that tobacco may be cultivated without much fear of failure. There can be no doubt that, if it were not for the fiscal restrictions arising from duties imposed upon tobacco by almost every government, the cultivation of it would be a great resource to native industry, especially on a small scale, by cottagers and gardeners. In Holland, of which the climate differs little from that of Great Britain, tobacco is cultivated to a very great extent, even in very poor soils, by great attention to manuring, and by accelerating the growth of the plant. The seed is sown in a well-prepared seed-bed in March, and protected by mats laid over hoops as long as the nights are cold and frost is dreaded. The ground in which the tobacco is to be transplanted is laid in narrow beds with intervals between them, which are dug out deep, as is done with asparagus-beds, and richly manured with sheeps' dung. These beds are two feet wide at top, and two feet six inches at bottom, with sloping sides to keep the earth up; the intervals are only six or eight inches, and serve not only as drains to keep the beds dry, but as paths from which the surface of the beds may be stirred and weeded. Two rows of plants about eight inches high are planted at equal distances along the beds; the rows are sixteen or eighteen inches apart, and the plants at the same distance from each other. In warmer climates the plants are placed three feet apart, as there they grow to a much greater size, and cover more ground; a moist day is chosen for transplanting. The plants are taken up carefully with a small spade or trowel without shaking the earth much from the roots; they are placed slanting in a shallow basket, and thus carried to the prepared beds; they should be vigorous, and have a stem six or eight inches long. They are inserted into holes made by a proper instrument, so that the fibres of the roots and the adhering earth may be completely buried up to the bottom of the stem: four or six leaves should be on the plant; if more, the lowest may be pinched off. If the ground was sufficiently moist, and no great heat or strong sunshine wither the plants, they will scarcely appear to have suffered from the removal; those which die, as must often be the case, are replaced by others left in the seed-bed for that purpose. Great attention must be paid to the beds all the time the tobacco is growing; weeds must be carefully eradicated, and the earth repeatedly stirred between the plants with hoes and narrow spades to accelerate the growth. When the leaves acquire a certain size, the lower leaves should be pinched off, to increase the bulk of the upper: for the former are apt to wither before the latter have acquired their full growth. A fine tobacco plant should have from eight to twelve large succulent leaves, and a stem from three to six feet high; the top should then be pinched off to prevent its running and drawing the sap from the leaves. Every lateral shoot should be carefully pinched off as soon as it appears, to prevent branching. A few plants are left for seed, and of these the heads are allowed to shoot the full length. The seeds are so small and so numerous on a plant, that a few plants produce a sufficiency of seed for the next crop. The plantations of tobacco are continually examined, and every leaf injured by insects or otherwise is pulled off. Tobacco takes about four months from the time of planting to come to perfection; that is, from May to September, when the leaves are gathered before there is any danger from frost: one single white frost would spoil the whole crop and cause it to rot. As soon as the colour of the leaves becomes of a paler green inclined to yellow, they are fit to be gathered; they then begin to droop, and emit a stronger odour, and they feel rough and somewhat brittle to the touch. When the dew is evaporated and the sun shines, the leaves may be most advantageously gathered, which is done by cutting down the plant close to the ground, or even a little under the surface. They are left on the ground to dry till the evening, taking care to turn them often, that they may dry equally and more rapidly. They are housed before the evening dew falls, which would injure them, and laid up under cover in heaps to sweat during the night; and some mats are thrown over the heaps to keep in the heat. If they are very full of juice, they are sometimes carried out again the next day to dry in the sun; but most commonly they are left to sweat for three or four days, and then moved and hung up to dry in sheds or buildings made for the purpose, like those in which paper is dried in the paper-mills, which allow a thorough draught of air, but keep out the rain.

Every tobacco plantation has such buildings, proportioned to the extent of the cultivation. The floors are most commonly only the soil on which they stand; but it is much better if they are boarded, because on the earth the plants are apt to be soiled, which injures the quality of the tobacco. In some places the leaves are now stripped off the stems and strung on packthread to hang them up to dry. In others the whole plant is hung on pegs placed in rows at regular distances, and fixed on laths which run across the building. All that is required is to place as many plants as possible without their being so near as to prevent the circulation of the air between them. When the plants are quite dry they are removed in moist or foggy weather: for if the air is very dry the leaves would fall to dust. They are laid in heaps on hurdles and covered over, that they may sweat again, which they do but slowly. The heaps are carefully examined from time to time to see that they do not heat too much; and, according to the season and the nature of the plants, whether more or less filled with sap, they remain so a week or a fortnight. This part of the process requires much attention and experience; for whether they do not heat to the proper degree or too much, in either case the quality is impaired. An experienced tobacco grower will ascertain the proper degree of heat better with his hand, than the ablest chemist could do with his thermometer. If the leaves were not stripped off at first, which is not the most common practice, they are taken off now, when the proper fermentation is completed, and sorted; those which grow on the top of the stem, in the middle, and at the bottom, are laid separately, as being of different qualities. They are tied together in bundles of ten or twelve leaves, and again dried carefully, when they are ranged in casks horizontally, and pressed in, by means of a round board, by lever or screw, as soon as a certain quantity has been laid in; the pressure is equal to that of a weight of several tons. This is essential to the safe transportation of the tobacco, and it is thus that the great bulk of it arrives from the places where its cultivation is most extensive, as in America.

The finest tobacco however is made into rolls, which from their shape are called *carrots*. The leaves are placed together by large handfuls, and wound very tightly round by strips of fibrous wood or strong grass, at a time when the air is somewhat moist; they partially consolidate, and require only to be rasped to make the finest and most genuine snuff, or rappée, as it is called. The snuffs commonly sold however are manufactured and prepared in a much more complicated manner.

The refuse stems of the tobacco are sometimes burned; but it is best to let them rot in the ground, where they are converted into good manure for the next crop. From the high state of cultivation of the land, it is left very rich for any other crop after the tobacco; but as this is quite a garden cultivation, the tobacco recurs very soon on the same ground; the abundant manuring and deep trenching prevent any bad effects from this frequent recurrence.

Manufacture.—Tobacco is packed in hogsheads for shipment: it is done with the greatest care, each bundle being laid separately. They are ranged side by side, and the direction of the points of the leaves is reversed with every alternate row. When the cask is about one-quarter filled, the tobacco is compressed by a powerful lever-press, which reduces the thickness of the layer from about twelve inches to three; and the pressure is continued several hours, that the tobacco may become so consolidated as not to spring up again when it is removed. In this way the cask is filled, by successive stages, until it contains a mass of tobacco-leaves so dense and compact, that a hogshead forty-eight inches in length, and thirty or thirty-two inches in diameter, will contain one thousand pounds.

Upon the arrival of the tobacco in this country it is conveyed to bonding-warehouses. Those of the metropolis, which are of immense extent, are situated at the London Docks, where every cask is opened, to examine its contents, and to remove any tobacco which may have been injured in the passage. This arrangement is rendered necessary by the operation of the high import-duty, which renders it better for the owner to sacrifice a large quantity of tobacco which may have become impaired in value (though not rendered valueless) than to pay the duty upon it. For the purpose of examination, the head of the hogshead is knocked out, some of the staves are loosened, and the hogshead is taken completely off from the tobacco. If it be found that, from defective packing, from the action of sea-water, or from any other cause, part of the surface has become so injured as not to be worth preserving, such part is removed, with large powerful cutting instruments, by small quantities at a time. This requires considerable power, owing to the intense compression of the tobacco, especially upon the cylindrical sides of the mass, where the cutters act across the direction of the stalks and leaves. The damaged tobacco thus removed is consumed in a furnace on the premises, which, with its chimney, is jocularly termed the '*queen's tobacco-pipe*.' The remainder of the mass is accurately weighed, and then returned into the hogshead.

The manufacture of the tobacco-leaves into the numerous varieties of *tobacco* for smoking in pipes—consisting of the leaf cut up into shreds or filaments, and usually divested of the stalk; into *cigars*, which are bundles of the tobacco-leaf rolled compactly together into a convenient form for smoking; and into *snuff*, which consists partly of the stalks of the leaves, and partly of the leaves themselves, cut and ground into the state of powder—is usually conducted by three distinct classes of individuals. The preparation of tobacco, properly so called, claims the first notice.

The first operation performed upon a hogshead of tobacco, after it has been removed to the manufactory and opened, is the digging out of the solid tobacco with iron instruments. The pieces thus detached are then sprinkled with water, which facilitates the separation of the small bundles from each other, and also of the leaves composing each bundle. If the tobacco be of the kind called 'handwork,' that is to say, with the stalks remaining attached to the leaves, it must now be stripped, unless indeed it be required for the production of a kind of tobacco called 'bird's-eye,' which contains a portion of stalk as well as leaf. The removal of the stalks is usually effected in England by women or boys, who fold the leaf along the middle, and, by means of a small instrument, applied with a dexterity acquired only by practice, separate the stalks from the leaves, and lay them aside in different heaps. To prepare them for being cut into shreds or filaments, the leaves are pressed together in large numbers in the form of a cake, during which operation they are occasionally moistened, not only to enable them to cake together the more readily, but also in order to improve the subsequent flavour of the tobacco. The details of the machinery employed for compressing and cutting the tobacco vary in different establishments. In that which is described in 'A Day at a Tobacco-Manufactory,' in the 'Penny Magazine,' the damp leaves are taken up out of a trough and laid in what is called a 'mortar-press,' several layers being piled upon each other. The whole is then subjected to pressure by means of an iron plate which descends into the press, and is forced down by a screw. The tobacco is next removed from the 'mortar-press' to the 'standing-press,' where it is compressed into one-third of its original thickness. The leaves remain several hours in this press, in order to destroy their elasticity. When removed from the press to the cutting-engine, the cake of leaves is as hard as a board; yet it retains a slight degree of clamminess or moisture from the previous sprinkling.

As manufacturing machinery generally has undergone, of late years, great changes and improvements, so it has been with the cutting-machinery of the tobacco-manufacturer. Originally it consisted simply of a long knife worked by hand. Hand-engines were then introduced, and such are still partially used, in which the knife is moved by a train of machinery, which also shifts the cake of tobacco between each cut, so as to make it ready for the next. This kind of cutting-engine is turned by a winch-handle, and the motion is regulated by a fly-wheel. Horses have been applied to a similar machine; and, lastly, steam-power has been brought to the aid of the manufacturer, leaving the attendance of men necessary only to place the cake in the engine, to attend to it while at work, and to remove the cut tobacco. Generally speaking, all of these machines act upon the same principle. The cake of leaves is laid upon an iron bed, which is susceptible of a slow progressive motion by means of a screw which passes beneath it, and is connected with a cog-wheel in such a manner that, while the machine is moving, the bed is constantly urged forward. Another part of the mechanism gives motion to the knife, which has a sharp blade, rather longer than the width of the cake, and is pivoted on a hinge or fulcrum at one end, the other rising and falling with the action of the machinery. The depth of the cake is about two inches, and the thickness of the film taken off by each stroke, and consequently the fineness or coarseness of the filaments of tobacco, is regulated by alterations in a train of cog-wheels. Other machines have been devised in which knives attached to the arms of a revolving wheel are to cut the tobacco in a similar manner to the action of a chaff-mill; but the writer is not aware that such have been brought into use.

Many circumstances combine to account for the different qualities and appearance of the numerous varieties of tobacco used for smoking. Tobaccos raised in various places naturally present some points of difference; variations will, as already shown, appear in different parts of the same crop; and the retention or rejection of the stalk, the nature and extent of the moistening, and the degree of fineness of the fibres, occasion still further differences. These varieties it is needless to notice further, unless the coarse variety called 'shag,' which is used both for chewing and smoking, be deemed a sufficient exception. It is formed of the darkest-coloured leaves, well liquored, which darkens them still more.

One other kind of tobacco claims notice: it is that known as 'pig-tail tobacco,' and consists of a rope or cord, about as large as the thicker end of a tobacco-pipe, and as long as the manufacturer can conveniently make it. It is produced by a process similar to spinning, and requires the simultaneous aid of a man and two boys. A bench several yards in length is made use of, with a spinning-wheel at one end, turned by one of the boys. The other boy arranges a number of damp leaves, with the stalks removed, end to end upon the bench, taking care to lay them smooth and open; and the man immediately follows him, and rolls up the leaves into the form of a cord by a peculiar motion of his hand. As fast as this is done, the finished tail is wound upon the spinning-wheel. It is transferred from the spinning-wheel, by the action of the machinery, to a frame connected with it; and subsequently it is wound or twisted up into a hard close ball, and darkened by steeping in tobacco-water.

The manufacture of cigars is exceedingly simple. One man or boy, with a quantity of unstripped leaves before him, takes them one by one, strips them as before described, and then passes them to the cigar-maker, who is seated on a low stool in front of a low work-bench, which has raised ledges on every side excepting that nearest to him. He takes a leaf of tobacco, spreads it smoothly before him on the bench, and cuts it to a form resembling one of the gores or stripes of a balloon. He then lays a few fragments of tobacco-leaf in its centre, and rolls the whole up into a form nearly resembling that of a cigar. The next operation is to place the partially formed cigar in an iron gauge, which cuts it to a given length. The maker then lays a narrow strip of leaf upon the bench, and rolls the cigar spirally in it. All this is done with great rapidity, a few seconds being sufficient for the production of a cigar. The cigars are finally dried for sale.

Snuff, which requires a higher degree of care in its manufacture than any other product of the tobacco-plant, is made either from stalks only, from leaves only, or from a mixture of the two. That known as Scotch snuff is made either wholly of stalks, or with a very small admixture of leaves; high-dried snuffs owe their peculiar qualities chiefly to a degree of drying which imparts a scorched flavour to them; and innumerable varieties are produced by the choice, mixture, and preparation of different tobaccos. Most of the snuff made near London is ground in mills whose machinery is impelled by the river Wandle, in and near to the small town of Mitcham in Surrey. In these mills two kinds of grinding-machine are employed, one consisting of two cylindrical stones, several feet in diameter, and one or more in thickness, set up on edge, side by side, upon a circular slab or bed. These stones have a two-fold motion imparted to them, resembling that of a carriage-wheel compelled to revolve in a small circle. The effect of this peculiar motion is a grinding action upon the bed where the snuff is laid, peculiarly adapted to the required purpose. Some kinds of snuff however are better ground by the other sort of machine, which consists of a kind of rolling pestle, set in motion by an ingenious train of wheels and set of jointed arms or levers. Little is done at the snuff-mills beyond a preparatory drying of the tobacco and the actual grinding; but the snuff usually receives some finishing operations from the maker after it leaves the mill.

(Porter's *Tropical Agriculturist; Penny Magazine*, No. 620.)

Trade.—The discoverers of the New World learned the habit of smoking tobacco from the natives, and on their return the practice was at first introduced into Spain and Portugal, and soon spread to other parts of the Continent. The settlers who accompanied Raleigh on his expedition to colonize Virginia, which returned unsuccessful in 1586, introduced the habit into England. Before the establishment of the colony of Virginia in 1606, all the tobacco imported into this country was raised by the Spaniards in the West India Islands. King James's invectives against the use of this weed are now curious matters of history. In 1604 he took upon himself, without the consent of parliament, to raise the duty on tobacco from 2*d.* to 6*s.* 10*d.* the lb. In the commission addressed on this occasion to the lord treasurer, he remarks that 'tobacco being a drug of late years found out and brought from foreign parts in small quantities, was taken and used by the better sort, both then and now, only as physic to preserve health;' but he goes on to say that persons of mean condition now consumed their wages and time in smoking tobacco, to their great injury and to the general corruption. In his 'Counterblast to Tobacco' he inveighed still more strongly against this 'precious stink.' In 1615 the colonists of Virginia regularly betook themselves to the cultivation of the tobacco-plant, abandoning the manufacture of ashes, soap, glass, tar, and the planting of vineyards, which they had already commenced. (Bancroft's *Hist. of United States*, i., p. 168.) James felt that in the infancy of the colony this proceeding of the planters must be tolerated, and without abating his well-known aversion to tobacco, he held, according to a proclamation, that it was 'of the two more tolerable that the same should be imported, amongst many other varieties and superfluities which come from beyond seas, than to be permitted to be planted here within this realm, thereby to abuse and misemploy the soil of this fruitful kingdom.' In the first instance he commanded that the production of tobacco should not exceed the rate of a cwt. for each individual planter. The cultivation was forbidden in England, and the plants already growing were ordered to be uprooted. At the same time he confined the right of importing the commodity to such persons as he should license for the purpose. In the last year of his reign the exclusive supply of the English market was given to the English plantations in America.

The tobacco duty now yields a gross revenue of about 3,500,000*l.* a year; only two articles of foreign production, sugar and tea, bring in a larger sum. Since 1825 the duty has been 3*s.* per lb., and 2*s.* 9*d.* if the produce of the British possessions in America. The value of the article in bond varies from 2½*d.* to 6*d.* per lb.; and the duty is therefore from 600 to 1440 per cent.: the average rate is said to be 900 per cent. From 1815 to 1825 the duty was 4*s.* the lb. In 1786 the duty in Great Britain was only 10*d.* per lb.; but in the following year it was increased to 1*s.* 3*d.*; in 1796 to 1*s.* 7*d.*; and it was successively increased at different times until it amounted to 4*s.* in 1815.

From 1794 to 1798, when the duty was 8*d.* the lb., the consumption of tobacco in Ireland averaged 8,000,000 lbs. yearly; but from 1825 to 1829, with a duty of 3*s.*, the consumption was only 4,000,000 lbs. Had it kept pace with the population, it would have been 16,000,000 lbs. The conclusion is that a large quantity of the tobacco consumed in Ireland was smuggled. The late Lord Sydenham, when president of the Board of Trade, stated that in one year seventy cargoes of tobacco had been smuggled between Waterford and the Giant's Causeway; and that the quantity thus introduced was not less than 3,500,000 lbs.

The consumption in Great Britain was as follows in each of the undermentioned years:—

1786	6,846,606 lbs.	Duty 10*d.*
1791	9,340,875	1*s.* 3*d.*
1796	10,047,843	1*s.* 7*d.*

For the following years the population of each decennial period is added:—

	Population.	Consumption.	Duty per lb.
1801	10,942,646	10,514,998 lbs.	1*s.* 7*d.*
1811	12,609,864	14,923,243	2*s.* 2*d.*
1821	14,391,631	12,983,198	4*s.*
1831	16,539,318	15,350,018	3*s.*
1841	18,535,786	16,000,000	3*s*

It thus appears that the consumption is now considerably less than one lb. per head: in Prussia it is three lbs. The allowance to British seamen for stores is two lbs. per month; and in 1798 the annual consumption in Ireland averaged two lbs. a head. It is impossible to believe that the use of tobacco has declined, or even been stationary, within the last few years: there is little doubt indeed of its having increased, though the returns give a different result. In 1828 only 8600 lbs. of cigars paid duty at 18*s.* the lb.; in 1831, the duty having been reduced one-half, 66,000 lbs. were entered for consumption; and in 1841 there were entered 213,613 lbs. The following table shows the quantities of unmanufactured tobacco on which duty has been paid in the United Kingdom in the three years and a half ending July, 1842:—

	1839. lbs.	1840. lbs.	1841. lbs.	Half-year ending 5th July, 1842. lbs.
England	15,686,245	15,475,431	14,590,129	7,189,166
Scotland	2,082,469	2,071,350	2,031,982	975,022
Ireland	5,202,692	5,355,617	5,473,477	2,663,522
United Kingdom	22,971,406	22,902,398	22,095,588	10,827,710

Smuggling and extensive adulteration of the article must be supposed to have had their effect in producing the above result, which has naturally alarmed the government; and an act has been passed (5 & 6 Victoria, c. 93) intended to remedy one of the sources of loss to the revenue, by again subjecting the manufacturers and dealers to the supervision of the excise. Up to 1825 both a customs and excise duty was collected on tobacco; but since that year the duty has been wholly collected by the officers of the customs at the ports of importation. A strict survey of the manufacturers' premises, and a registry of their operations and the sales of the retail dealers, were still kept up by the excise, though they no longer collected any duty. This survey was at length abolished in 1840, by the 3 & 4 Vict., c. 18: it is now partially re-established. The nature of the adulterations practised may be gathered from one of the clauses of the Act 5 & 6 Vict., which prohibits, under a penalty of 200*l.*, manufacturers having in their possession 'any sugar, treacle, molasses, or honey, or any commings or roots of malt, or any ground or unground roasted grain, ground or unground chicory, lime, sand (not being tobacco sand), umbre, ochre, or other earths, sea-weed, ground or powdered, wood, moss, or weeds, or any leaves, or any herbs or plants (not being tobacco leaves or plants) respectively, nor any substance or material, syrup, liquid, or preparation, matter or thing, to be used or capable of being used as a substitute for or to increase the weight of tobacco or snuff.' The price of tobacco has risen in consequence of the Act being strictly enforced. In the last year of the excise survey (1839) the quantities of the different kinds of tobacco and snuff sent out by permit from the manufacturers of the United Kingdom were as under:—

	Cut or Shag Tobacco.	Roll Tobacco.	Cigars.	Rappee Snuff.	Scotch Snuff.	Brown Scotch Snuff.	Tobacco-Stalk Flour.	Total.
England . . lbs.	13,221,111	1,152,695	538,971	566,682	1,184,014	211,557	72,763	16,947,793
Scotland . . lbs.	4,511	1,760,977	..	643,614	1,063	152	..	2,410,317
Ireland . . lbs.	2,305	3,557,313	1,462	2,097	200,885	670	51,905	3,816,637
United Kingdom	13,227,927	6,470,985	540,433	1,212,393	1,385,962	212,379	124,668	23,174,747

The number of tobacco and snuff manufacturers in 1839 was—England, 309; Scotland, 130; Ireland, 227; total 666: of dealers—England, 158,385; Scotland, 13,432; Ireland, 13,938: total, 185,755.

Tobacco, as already stated, is not allowed to be grown in England. The acts prohibiting its cultivation did not until lately apply to Ireland. In Prussia 24,748 acres were planted with tobacco in 1835: in France, in 1840, the produce of home-grown tobacco was 175,015 cwt., on 19,662 acres: the duty on tobacco in France yields about 3,800,000*l.* per annum. Tobacco is extensively cultivated in Holland and Belgium, also in the southern provinces of Russia, and in Turkey and Syria. It has as yet made little progress in the British West Indies, and still less in Upper Canada, though encouraged by a small differential duty of 3*d.* in the lb. It is said that East India tobacco would be much more extensively introduced if a similar preference were shown to it. The tobacco of Cuba holds the highest rank for the excellence of its flavour. In 1833 the export of cigars was 3,320,207 lbs., and of leaf tobacco 2,346,545 lbs. Next in favour, perhaps, are the cigars of Manilla. But the cultivation of tobacco is most extensive in the United States. In 1836 the value of the exports was 10,000,000 dollars, being one-seventh of the value of the cotton exported; in 1838 the value of tobacco exported was 7,392,029 dollars; in 1839, 9,882,943 dollars; and in 1841 it was 12,576,703 dollars. The following table gives a general view of the trade of England in tobacco:—

	Imported from the United States. lbs.	Total Imported. lbs.	Re-exported. lbs.	Paid Duty for Home Consumption. Unmanufactured. lbs.	Paid Duty for Home Consumption. Manufac. and Snuff. lbs.	Net Revenue. £
1831	32,712,108	33,107,679	9,358,356	19,418,940	114,900	2,964,592
1832	19,522,807	19,967,035	6,754,950	20,086,717	148,750	3,080,598
1833	20,743,317	22,082,579	8,066,762	20,502,971	143,993	3,140,084
1834	37,804,872	38,517,861	12,989,951	21,048,324	145,546	3,223,048
1835	24,955,419	25,532,611	13,218,897	21,803,775	141,813	3,331,224
1836	51,208,757	52,232,907	12,319,305	22,150,784	158,060	3,397,102
1837	26,353,973	27,144,107	17,341,587	22,321,459	144,736	3,417,663
1838	29,191,543	30,162,024	11,610,495	23,149,786	190,010	3,561,812
1839	33,888,120	35,605,253	9,227,518	22,773,905	196,260	3,495,687
1840	34,623,836	36,680,837	12,224,594	22,682,857	193,781	

We give another table further illustrating the commercial intercourse created by the demand for tobacco: it shows the countries from which tobacco was imported in 1839:—

Countries from which Imported.	Unmanufactured Tobacco. lbs.	Manufactured and Cigars. lbs.	Snuff. lbs.	Total. lbs.
United States of America . .	33,888,120	931,861	6	34,819,987
Mexico	..	375	..	375
Columbia	22,509	5	..	22,514
Brazil	132,287	345,670	12	477,969
Cuba	389,381	214,410	3	603,794
Hayti	167,862	247	1	168,110
British West Indies . . .	84,295	4,163	48	88,506
East India Company's Territories	97,827	41,741	48	139,616
Philippine Islands . . .	114	12,249	..	12,363
Turkey, Syria, and Egypt . .	3,200	22	..	3,222
Holland	559,240	11,292	710	571,242
Belgium	106,196	245	10,744	117,185
Germany	114,973	51,841	9	166,823
Other Countries	39,249	6,528	96	45,873
Total . .	35,605,253	1,610,649	11,677	37,227,579

Tobacco is not allowed to be imported in vessels of less than 120 tons, nor exported in those under 70 tons. The places of import are limited to a few of the principal ports where it can be safely secured under the king's lock. A charge of 2*s.* per hhd. is made on its being placed in the warehouse, and the same sum when it is taken out; but no other payment as rent is due for five years. Of 37,000,000 lbs. imported in one year, 20,000,000 arrived in the port of London, and 14,750,000 lbs. at Liverpool. The tobacco exported is principally to Germany, Holland, Belgium, Spain, Italy, the West of Africa, and Portugal, and to other parts in smaller quantities.

TOBACCO-PIPE, a long slender tube, of very small bore, used for inhaling the fumes of a small quantity of burning tobacco deposited in a bowl or cavity attached to one end of the tube.

The materials of which tobacco-pipes are formed are very numerous. White and coloured earths, porcelain, metals, ivory, horn, shell, costly woods, agate, cornelian, talc, and amber, are among the substances which have been used for the purpose. The forms of tobacco-pipes admit of at least equal variety, but perhaps the most remarkable is the oriental hookah, in which the smoke is purified by passing it through water. This is effected by having an air-tight vessel half filled with water. On the top of this vessel is a bowl to contain the burning tobacco, and a small tube descends from the bowl into the water in the lower vessel. The pipe is inserted into the upper part of the vessel, above the level of the water. When the smoker begins to draw through the pipe, he produces a partial vacuum in the vessel, and this occasions the pressure of the external air to force the smoke of the tobacco downwards, through the small tube before mentioned, into the water beneath. After losing its solid particles in the water, the smoke bubbles up into the vacant space above, and thence passes through the pipe to the smoker's mouth. The pipe or tube is usually made flexible, and is often of great length.

The tobacco-pipes most commonly used in this country are formed of a fine-grained plastic white clay, which is called, from this application, pipe-clay. It is procured chiefly from Purbeck in Dorsetshire, and it is purified from all foreign substances by working it with water into a thin paste, and then either allowing it to settle in pits, or passing it through a sieve, to separate the siliceous or other stony matter. The water is subsequently evaporated until the clay becomes of a doughy consistence, when it must be well kneaded to make it uniform. It is finally formed into cubical masses of about one hundred pounds each, and from one of these the workman cuts off just enough to make one pipe. Each piece is kneaded thoroughly upon a board, and rolled out to nearly the form and size of a pipe, with a projecting bulb at one end for the formation of the bowl. These pieces are laid aside for some time to dry, and when the clay is sufficiently firm, they are subjected to the curious process of boring. The workman takes the roll of clay in his left hand, and with his right inserts the end of an iron needle, previously oiled, in the small end of the roll, and by dexterous management thrusts the needle through the whole length of the roll, without penetrating the surface. The bulb is then bent into the proper position to form the bowl, and the piece of clay, with the needle remaining in it, is pressed into a mould to complete its form.

Tobacco-pipe-moulds are formed either of copper, brass, or iron, and each consists of two precisely similar halves, with projecting pins in one half, and corresponding holes in the other, which ensure their exact union. On their inner surfaces, which are hollowed so as to fit the finished pipe, may be added any ornamental device or inscription. One half of the mould being laid flat, the pipe is placed in it, covered with the other half, and then firmly pressed. The bowl is partially hollowed by the finger, and completed by the insertion of an oiled stopper or mould. The wire should then be thrust backwards and forwards until it becomes visible in the bowl. The wires are now withdrawn, and the pipes are taken out of the moulds, slightly smoothed over, and laid aside to dry. After drying for a day or two, any remaining roughness is removed by means of an instrument of bone or hard wood, and then the pipes are sometimes moulded a second time, and polished with a piece of flint bored with holes, through which the stem is passed repeatedly. Hitherto the pipes are straight in the stem; but before going to the kiln they are slightly bent. It is said that a clever pipe-moulder will make three thousand five hundred in one day.

The tobacco-pipe-kiln consists of a large but very light cylindrical crucible, or sagger, with a dome-shaped top, and a circular opening in one side for the insertion of the pipes. This vessel is formed in the following curious manner:—The bottom is composed of fragments of pipe-stems, radiating from the centre, and coated at the circumference with a layer of clay. A number of bowls of broken pipes are inserted in this clay, and in these bowls other fragments of pipe are placed upright to form the sides of the cylinder. The addition of a little clay, in a similar manner to lath-and-plaster work, completes the solidity of the work; and in this way the whole of the vessel, including the domed roof, and a series of vertical projecting ribs on the outside of the cylinder, is completed. In like way, also, the aperture by which the charge is inserted is closed. This crucible or sagger is mounted in a brick furnace, lined with fire-brick, in such a manner as to leave a space of about four inches all round for the circulation of flame; and the effect of the before-mentioned fillets is to divide this space into a series of flues, between which however there is some communication through apertures in the fillets. The pipes are placed in the kiln with their bowls against the circumference, and their ends supported at a considerable elevation upon circular pieces of clay set up in the centre. Six small ribs project inwards round the interior of the crucible, at various elevations, and each of these will receive a range of bowls, while successive points of support are provided in the centre for the pipes. By this arrangement one furnace may contain fifty gross, or seven thousand two hundred pipes, which may all be baked within eight or nine hours. During the operation the fire may be raised or damped, if necessary, by a plate sliding over the chimney-top. The tobacco-pipe-kiln is engraved and more fully described in Dr. Ure's 'Dictionary of Arts.' (*Penny Magazine*, No. 496; Dr. Ure's *Dictionary of Arts, &c.*, pp. 1256, 1257.)

TOBAGO, an island in the Columbian Archipelago, in 11° 16′ N. lat. and 60° 30′ W. long. It is the most southern of the Caribbee Islands, and lies about 25 miles north of Trinidad. Its greatest length is 32 miles, and greatest breadth about 13 miles. A mountainous ridge 1800 feet high extends two-thirds of the length of the island, and smaller ones proceed from it, rendering the general surface of the interior irregular and abrupt. The valleys and ravines are well watered, and there are alluvial plains of small extent. The northern coast is lofty and rugged, and the southern terminates in lowlands. Conical elevations, which slope with a gentle descent, are often found isolated, and as if rounded by the action of water. There are none of the volcanic features which most of the neighbouring islands present. Tobago is out of the range of hurricanes. There are harbours on both the northern and southern coasts for vessels of 150 tons. The capital and chief port is Scarborough, on the northern coast. The climate is said to be healthy in some accounts, but this may possibly only refer to the elevated lands in the interior. Statistical returns show that the mortality of the troops stationed in Tobago has always been higher than in any of the other islands of the West Indies. The exports consist almost solely of the produce of the sugar-cane. In 1836, 109,640 cwts. of sugar, 128,970 gals. of molasses, and 435,994 gals. of rum were exported, the total value of which was estimated at 196,974*l.* In the same year the estimated value of the imports was 73,947*l.* In 1839 the exports were two-fifths less than in 1836, and in 1841 still less, but small quantities of cotton and arrow-root were shipped.

The population of the island in 1835 was 10,385, consisting of 250 male and 30 female whites; 300 free blacks, and 9805 apprenticed (black) labourers. On the 1st of August, 1834, the number of registered slaves was 11,589, for whose emancipation 233,875*l.*, or 20*l.* 3*s.* 7*d.* per head, was paid out of the parliamentary grant. On obtaining their freedom many of them proceeded to the other islands, in which there was a greater demand for labour.

Tobago was discovered by Columbus in 1496, and derives its name from the pipe ('tobacco') used by the natives in smoking the herb 'kohiba' (tobacco). At an early period the British flag was planted on the island, and James I. granted it to the Earl of Pembroke, but no attempt was made by the English to colonise it. In 1632 the Dutch formed a settlement and called the island New Walcheren, but the Spaniards from Trinidad attacked and destroyed the colony. Twenty years afterwards the Dutch returned, and soon after a party of about a hundred Courlanders arrived, the Duke of Courland, godson of James I., having obtained a grant of the island. In the disputes which arose between them and the Dutch the latter were successful. The subsequent history of the island is not of general interest. (Edwards's *West Indies*, vol. iv., p. 275.) In 1763 it was ceded by France to England. In 1781 the French captured it, and in 1783 it was regularly ceded to France by the treaty of Versailles. In 1793 General Cuyler and 2000 men took the island, and it has ever since been a British possession. Tobago has a local legislature, consisting of the lieutenant-governor, a legislative council of nine, and a house of assembly of sixteen members.

TOBIN, JOHN. The author of one play which still holds possession of the stage—a play of considerable merit, although displaying little of what may be termed original genius—would scarcely be entitled to notice in a work which does not profess to include the minor adventurers in literature, were it not for the peculiar circumstances under which he devoted a life to dramatic writing. John Tobin was born at Salisbury in 1770. His father had property in the Isle of Nevis, and from the political circumstances of the period, thinking his presence necessary upon his plantation, he took up his residence there, leaving three sons under the care of their maternal grandfather. They were placed at the free-school at Southampton, where John discovered some precocious talents. His father, returning to England, settled at Bristol in a mercantile employment, where his sons became pupils of the Rev. Mr. Lee. John, who was the third son, was in 1785 placed in the house of a London solicitor, in which house he eventually became a partner. His ambition was however early directed to dramatic composition, and for fifteen years he persevered in offering to the theatres play after play, each of which was uniformly rejected by the managers. Tobin had perhaps more real talent than the greater number of those who had possession of the stage, at a period when a successful dramatic performance was not only highly paid, according to any commercial estimate of literary merit, but was very often a little fortune to its author. But the stage was then also in the hands of three or four writers, who perfectly understood the taste of the town, and especially adapted themselves to the peculiarities of the actors who were to represent their characters. It was a necessary consequence of this system that whilst no drama was composed upon a principle of art—whilst no attempt was made to sustain a plot by consistent and natural character, wit or humour, pathos or poetry—whilst the author modelled his jokes according to his conception of this comedian's flexibility of face, and his sentiment with a due reverence for that tragedian's stride and intonation,—there was still something produced which was perfect in its way, through the power of the machinery by which it was worked; a thing to move laughter or tears upon the stage, but singularly provocative of sleep in the closet. This was the day when the drama existed upon slang and clap trap, miscalled comedy. Tragedy had died out in its dullness; and farce —not legitimate farce—demanded the five acts of Reynolds, Morton, and George Colman the Younger. At this period Tobin essayed to become a writer of comedy. He produced 'The Faro-Table,' 'The Undertaker,' and 'The School for Authors.' These were all rejected. He then tried his hand at the romantic drama, and wrote with equal ill success 'The Curfew' and 'The Indians.' The latter piece was called forth by the success of Sheridan's melodrama of 'Pizarro.' Some one, it is said, proposed this question to Tobin at a social meeting where the state of the drama was a subject of discussion: 'Would a revival of the dramatic spirit which produced the plays of Shakspere and Fletcher be relished by the public?' Tobin thought it would, and he wrote 'The Honeymoon.' This play was presented to the managers of Covent-Garden, and refused. It was finally accepted at Drury-Lane, and it was acted with a success which has attended very few dramatic compositions. In the mean time its author, who had a tendency to consumption, was obliged to leave London, seeking the recovery of his health. He had worked for many years at his profession by day, and at his dramatic compositions by night. He died on the 8th of December, 1804; and 'The Honeymoon' was produced at Drury-Lane on the 31st of January, 1805. Those who cater for the public taste have often an alacrity in discovering the merits of a man when he is dead; and so Tobin's rejected pieces were eventually brought upon the stage. They are forgotten. 'The Honeymoon' is exactly such a piece as might have been calculated upon, looking at the theory which is said to have suggested it. It is throughout an imitation of the old dramatists; clever indeed—but as an automaton compared to a man, for the breath of poetical life has not been breathed into what moves before us in the attitudes of humanity. The dialogue is skilful, the chief situations are interesting, there is a proper quantity of simile and other embroidery which looks like poetry. But the high art with which the old dramatists worked is not there. Tobin did the best he could as an imitator; but the Shaksperian drama is not a thing for imitation. The great and essential spirit of poetry is ever the same; but it only becomes original as it puts on new forms, the elements of which are to be found in the aggregate thought of its own age. The memoirs of John Tobin, with several of his unacted dramas, were published by Miss Benger, in 1820.

TOBIT (Τωβίτ: according to the Vulgate, *Tobias*), a canonical book of the Old Testament, according to the Roman Catholics, but the divine authority of which is rejected by the Protestants. This book contains the history of Tobit, and purports to be written by himself.

Tobit was a native of Thisbe in Galilee, and belonged to the tribe of Naphtali. He had one son named Tobias: and while the rest of his tribe sacrificed to Baal, he remained steadfast in the worship of the Lord. He, with his wife and son, accompanied the other Israelites in their captivity to Nineveh, where he gained the favour of the king Shalmanesar, and was appointed his purveyor. He was thus enabled to acquire considerable property; but was deprived of it all in the reign of Sennacherib, in consequence of having buried some Israelites whom the king had slain, and he was obliged to flee from the city. He was however recalled to Nineveh on the accession of Esarhaddon, through the influence of Achicharius, who was his own nephew, and held high offices in the court of the king. Not long afterwards he buried again one of his countrymen who had been slain, and being polluted, he did not enter his house, but slept outside by the wall of the courtyard with his face uncovered. While lying here the sparrows dropped some warm dung into his eyes, which occasioned total blindness. Tobit however did not lose his confidence in God. Being reduced to poverty, he sent his son Tobias to Rages (Rhagæ) in Media, to obtain a sum of ten talents, which he had left some years before with one Gabael. Tobias was accompanied in his journey by an angel, who, under the form of an Israelite of the name of Azarias, was so kind as to offer himself as a guide. In the course of their journey Tobias caught a fish in the Tigris, of which he carefully preserved the heart, the liver, and the gall, according to the directions of the angel, who explained their wondrous efficacy. At length they arrived at Ecbatana, where Tobias married the daughter of Raguel, his kinsman. Now the damsel had already been married to seven husbands, but on the wedding-night of each the evil spirit Asmodeus had killed them. Tobias however burnt the liver and the heart of the fish, as he was ordered by the angel, and by the smoke arising from them drove the evil spirit straightway into Egypt. As Raguel would not let his son-in-law leave Ecbatana immediately, the angel was sent to Rages for the money; and upon his returning with it, Tobias went back to Nineveh, where he cured his father's blindness by rubbing his eyes with the gall of the fish. Tobit continued to live happily till the time of his death, which did not take place till he was a hundred and fifty-eight years old. After the death of his parents Tobias removed to Ecbatana with his wife and children, and died at the age of a hundred and twenty-seven years.

The Book of Tobit is written in rather a pleasing style. Sound criticism will scarcely regard it as a true history. It is rather a tale written to inculcate the duty of trust in God, and to show how such confidence will be recompensed eventually. It also abounds in exhortations to practise good works, and to continue steadfast in prayer.

The translation in the Vulgate was made by St. Jerome from the Chaldee. It also exists in Greek, which is probably a translation of an old Hebrew original, of which the Chaldee text used by St. Jerome was perhaps also a translation. There is a Syriac version besides, which differs considerably from the Greek and Latin ones. It seems impossible to determine with any accuracy the time when the book was written.

(K. D. Ilgen, *Die Geschichte Tobi's nach drei verschiedenen Originalen, dem griech., dem latein. des Hieronymus und einem syr. übersetzt mit Anmerkungen*, &c., Jen., 1800; De Wette, *Einleitung in die Bücher des Alten Testamentes*, p. 381, &c.)

TOBOLSK. Asiatic Russia, or the kingdom of Siberia, was formerly divided into two great governments, Western and Eastern Siberia, Tobolsk being the western and Irkutzk the eastern. Tobolsk was subdivided into the provinces of Tobolsk, Omsk, and Tomsk. Subsequently Tomsk was erected into a separate government; and in 1838 the province of Omsk was divided between Tobolsk and Tomsk. The government of Tobolsk, as now constituted, is bounded on the north by the Frozen Ocean, on the west by the governments of Archangel, Orenburg, and Perm, and on the south and east by Tomsk and Jenisseisk: the area is 519,200 square miles, and the number of inhabitants is 822,684, not including the part of the province of Omsk which was incorporated with it in 1838. On the west it is separated from European Russia by the chain of the Ural Mountains. The principal rivers are the Obi, the Tobol, the Irtisch, and the Tura. In the south and south-western parts the summer is warm and pleasant; the winter is very cold, and much snow falls. In the short summer there are some hot days, but when the wind blows from the Frozen Ocean, which frequently happens, the cold becomes very cutting. The south and south-western parts of the government are very fertile, and produce abundance of corn and flax. The really agricultural districts are on the west, on the Tobol and its tributaries, which yield luxuriant crops, and supply with grain not only the tracts to the north, but the governments of Perm and Orenburg. There are also rich pastures favourable for the breeding of horned cattle, horses, and sheep. Here and there some camels are bred. This part of Siberia is equally remarkable for the prodigious quantity and value of the fish in the great rivers. The mineral wealth contained in the mountains on the west and southern frontiers is immense. The Ural Mountains produce iron, copper, gold, and platina; and the forges of Ekaterinenburg are among the most extensive in the world. From the shores of the Frozen Ocean to 60° N. lat. the whole country is totally unfit for agriculture. It is covered with thick forests, the ground of which is a morass; these gradually give way to a few pines and stunted shrubs, and these too entirely disappear towards the Frozen Ocean, where a little moss is almost the only sign of vegetation. The fishery and the chase of the fur-bearing animals are the only resources of this inhospitable tract. The sable however, the most highly prized of these animals, is nearly extirpated. Besides the Russians there are among the inhabitants Mongols, Bokharians, Tunguses, Samoieds, Ostiaks, and wandering Tartars of different tribes. The necessaries of life being abundant and cheap, the inhabitants have no sufficient stimulus to rouse them from the indolence which appears to be a predominant characteristic of the people of this region.

TOBOLSK, the capital of the government of Tobolsk, is situated in 58° 12′ N. lat. and 68° 15′ E. long., at the junction of the Tobol with the Irtisch, 582 feet above the level of the Caspian Sea. It is divided into the upper and the lower town: the former, on the east bank of the Irtisch, is on a hill, or rather ridge, which runs parallel to the river, at a small distance from it; the latter, which is the larger, is in the interval between the ridge and the river, and is exposed to inundations. The communication between the upper and lower town is by a gently rising causeway laid with planks, which is continued in a ravine of the ridge, and is practicable even for carriages. The view from the summit, which is 200 feet above the lower town, though not very diversified, is striking; the great river, running in a semicircle, is the principal object; on the right hand is the lower town; beyond the river is a verdant plain extending to the horizon, the uniformity of which is interrupted only by the Tobol, of which there are glimpses here and there, and by isolated Russian and Tartar villages, most of which are near the river, and among them the Tartar villages are always to be recognised by a little grove of trees (not pines), which are their burying-grounds. At the foot of the ridge some springs issue, of which Professor Rose examined two, and found the temperature of one to be 4·2°, that of the other 4·6°, by Réaumur's thermometer; this temperature, he says, is manifestly too high for the latitude of Tobolsk to be considered the mean temperature of the earth. Professor Erman, who passed several months at Tobolsk in 1829, found the temperature of the earth to be only 1·8° of Réaumur's thermometer.

Tobolsk is the see of a Russian archbishop, the metropolitan of all Siberia, and has a theological seminary, an establishment for the education of schoolmasters, a gymnasium, and several other schools; some printing-offices, a Bible Society, and a theatre. The only manufactures of importance are of Russia leather; the Russian and Tartar women make linen, carpets, and woollen cloth. There are in all twenty-three churches, one German Protestant church, two mosques, two convents, and the residence of the governor-general. The population, consisting of Russians, Germans, and Tartars (the last are about a fourth part of the whole), amounts to 20,000, exclusive of the soldiers, the clergy, and the exiles, for whom there is a house of correction. The Tartars were formerly allowed to live in the lower town, where a number of streets were assigned to them; but the crowded manner in which they built their houses, rendering them very liable to fire, which spread to the Russian streets, the Tartars were removed to a separate quarter. The style of living and the manners of the upper classes of society are not very different from those of Europe. Kotzebue, during his exile, had the gratification of seeing some of his own plays performed in the theatre of Tobolsk; and Dr. Clarke was of opinion that in his time the society was as good as in any Russian city; and it has doubtless continued to improve.* The inhabitants are distinguished for their hospitality to strangers. Game is so extremely abundant in the vicinity of the city, that partridges and grouse are the daily and almost necessary food of all classes. The cock of the wood is not found in great numbers near the city till the winter has become severe, but is brought from the country of the Ostiaks, to the north, all the year round, as well as the black cock and other game. The common use of these and other articles of food, which in Europe are chiefly confined to the tables of the richer inhabitants, 'forcibly reminds us,' says Professor Erman, 'of the remark of Paulus Jovius, in the sixteenth century, who affirmed that the Russians lived less with refined elegance than in the greatest abundance, for that the tables of the Russians were constantly supplied, and at a cheap rate, with viands which in Europe none but the most prodigal (luxuriosissimi) wished for or could obtain.' (See Pauli Jovii *De legat. Basilii Magni*, *Princip. Moscov. ad Clementem VII.*, *Pontific. Max. liber.* *In Comm. Rer. Moscov.*, p. 170.)

Though Tobolsk has no manufactures, it has a very considerable transit-trade between European Russia and China. The European traders arrive in the spring with the goods destined for the Chinese, and at the end of summer the boats return with their cargoes for Moscow and Petersburg. The merchants from Tartary and Bokhara arrive at the beginning of the winter, and remain at Tobolsk till the spring. All the sums collected as tribute from the wandering tribes of the immense deserts are brought to Tobolsk, where there are extensive magazines for the various descriptions of goods.

In 1756 the Abbé Chappe d'Auteroche was sent by Louis XV. to Tobolsk to observe the transit of Venus. He erected a small observatory, and determined astronomically the position of Tobolsk. Though no traces of the observatory now remain, Professor Erman, after much inquiry, ascertained the spot where it stood, and found his observations very nearly corresponding with those of Chappe:—

Latitude, according to Chappe, 58° 12′ 22″ N.
Latitude, according to Erman, 58° 12′ 13″.9 N.

Humboldt's observations nearly coincide with the above.

(Adolph Erman, *Reise um die Erde durch Nord Asien und die Beiden Oceanen, en* 1828, 1829, *et* 1830, erster und zweiter band; A. von Humboldt, G. Ehrenberg, and G. Rose, *Reise nach dem Ural, dem Altai, und dem Kaspischen Meere*, erster band, Berlin, 1837; Hörschelmann; Cannabich.)

TOCUYO. [VENEZUELA.]

TOD, an old measure of wool, fixed at two stones, or 28 pounds averdupois, by a statute of the 12th of Charles II. As usual, there are several local tods.

TODDA'LIA, a genus of plants of the natural family of Rutaceæ, tribe Xanthoxyleæ, which is itself sometimes made into a distinct order. The name Toddalia is derived from Toddali, the Malabar name of one of the species. The genus is distinguished by having unisexual flowers, the calyx 5-toothed. Petals 5. Stamens 5, longer than the petals. Stigma almost sessile, peltate. Fruit fleshy, 5-furrowed, 5-celled, cells 1-seeded. Seed kidney-shaped. Embryo arched. The species consist of moderate-sized shrubs, with alternate trifoliate leaves full of pellucid dots. Male and female flowers on different branches of the same tree. Flowers in axillary or terminal racemes or panicles. The species are few in number, and found in the hot parts of India and in the Mauritius, as well as in Brazil. The Indian species are found in the Peninsula, but extend northwards as far as Nepaul and Deyra Doon; from Nepaul Dr. Wallich figured T. floribunda (*Pl. As. Rar.*, t. 232). T. aculeata has prickly stems and branches, and extends to 30° N. lat., along the jungly base of the Himalayan Mountains. The bark and root of this species are said to be used as a cure for the remittent fever of such situations; and as many of the allied plants are possessed of bitter with aromatic properties, it is probable that this plant also may be useful for such purposes.

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* The first elements of European civilization were introduced by the numerous Swedish prisoners of war taken at the battle of Pultowa, who were at that time far better informed and more polished than the Russians.

TODI. [Perugia.]

TODIRA'MPHUS. [Kingfishers, vol. xiii., p. 229.]

TODUS. [Muscicapidæ, vol. xvi., p. 14.]

TOEPLITZ. [Teplitz.]

TOFA'NA. [Aqua Tofana.]

TOGA is the name given to the principal outer garment worn by the Romans. The Romans generally wore the same kind of dress as the other Italian nations and the Greeks; the toga alone is by some writers said to have been derived from the Lydians, but this statement probably arose from the belief that the Etruscans had come from Lydia; and that at least a particular kind of toga (the toga praetexta) was introduced at Rome at a very early time from Etruria, is expressly stated. (Livy, i. 8; Pliny, *Hist. Nat.*, viii. 74.) In later times the toga was the peculiar garment of the Romans, which in times of peace they wore both at home and abroad, and whenever they appeared in full dress. Hence they are called gens togata (Virgil, *Aen.*, i. 282) and togati (Sallust, *Jugurth.*, 21), in contradistinction from other nations. The name 'toga' was, according to Varro (*De Ling. Lat.*, iv., p. 33, ed. Bipont.), derived from *tegere*, 'to cover,' because it covered the whole body. Gellius (vii. 12) states that in early times it was the only article of dress that was worn, but afterwards we know that it was worn over other dresses. The right of wearing it was the exclusive privilege of Roman citizens of every age and sex. (Servius, *ad Aen.*, i. 282.) Slaves, foreigners, and Romans sent into exile were not allowed to wear it. (Pliny, *Epist.*, iv. 11; Horat., *Carm.*, iii. 5, 10.) The peculiarity of the toga as a Roman dress is also indicated by the circumstance that comedies in which Romans appeared on the stage and were represented with their native costume, were called 'togatae,' to distinguish them from Greek comedies. As the toga covered the whole body with the exception of the left arm, it could not be worn by a person while at work either at home or in the field. (Juvenal, iii. 171; Livy, iii. 26.)

The material of which the toga was made was woollen cloth, which differed in thickness and fineness according to circumstances and the seasons. Under the empire persons of rank used to have their togas made of silk. The colour was usually white, probably the natural colour of the wool. Those who appeared before the people as candidates for a public office, wore a particularly white and clean toga (candida), whence they derived their name of candidates (candidati). On festive occasions too it was considered a matter of importance that the toga should be perfectly white. (Horat., *Sat.*, ii. 2. 60; Cicero, *in Vatin.*, 13.) On melancholy occasions the Romans wore the toga pulla, or 'dark-coloured toga.' (Cicero, *in Vatin.*, 13; *in Verr.*, iv. 24.) Whether, however, the word pulla refers to a particular dye, or whether it only means a dirty and worn-out toga, which was also put on with less care than usual, as seems to follow from the adjectives sordida and squalida, which are often given to it (Livy, ii. 54; xlv. 20), is not quite certain, though it is a well-known fact that the mourning colour among the Romans was a dark blue. Towards the end of the republic and under the empire the toga, especially that worn by the emperors, was of a purple colour, and was called trabea. This custom appears to have been introduced by Julius Cæsar. (Cicero, *Philip.*, ii. 34; Servius, *ad Aen.*, vii. 612.) As early as the time of Augustus many Romans had left off wearing the toga, and taken to a kind of cloak called lacerna. This induced the emperor, who was fond of restoring antient customs, to enjoin the aediles to see that no Roman should appear in the forum or circus without the toga. (Sueton., *Aug.*, 40.) The toga during the empire continued to be the honourable dress which was worn by persons of rank, as senators, judges, priests, and by clients when they saluted their patrons or received the sportula (Martial, xiv. 125), and especially on all occasions where the emperor was present.

The mode or fashion of wearing the toga appears to have been variously modified in the course of time, although the general character always remained the same. A great difference seems to have existed in the quantity of cloth used for it, as some statues present a richer drapery than others. Respecting its form and the manner of putting it on, nothing can be said with certainty, notwithstanding the description in Quinctilian (xi. 3, 137, &c.) and the many statues with togas still extant. Those who are curious about this matter may consult an excellent article in the 'Dictionary of Greek and Roman Antiquities,' under 'Toga.'

Besides the different kinds of togas we have mentioned above, the following must be noticed:—

1. *Toga praetexta* was worn by the children of the nobles, by girls until they married, and by boys until they attained the age of puberty (fourteen), when they exchanged it for the toga virilis, also called pura, libera, or recta, which was the usual white toga described above. The praetexta was also the official robe of the higher magistrates of the city and the municipia, as well as of the colonies. The name praetexta was derived from the circumstance of this toga being adorned with a broad purple border (latus clavus).

2. *Toga picta* was a toga ornamented with embroidery and gold according to the Etruscan fashion. It was worn by generals in their triumph, whence it was also called toga Capitolina. During the empire it was also worn by the consuls and praetors when they were present at the public games.

(Ferrarius and Rubenius, *De Re Vestiaria*; Becker, *Gallus*, ii., p. 78, &c.; *Dictionary of Greek and Roman Antiquities*, under 'Toga.')

TOGGENBURG, the Upper and Lower, a long valley in the north of Switzerland, was formerly the name of a county lying between the territories of the Abbey of St. Gallen, the Thurgau (Thurgovia), and the cantons of Zürich and Appenzell. It is separated from these cantons by mountains, which contract its breadth; it is however above 50 miles in length, and its area 250 square miles. It is traversed by the river Thur, from which it is sometimes called the Thurthal (or Valley of the Thur). The chief occupations of the inhabitants are agriculture, pasturage, and partly weaving linen and spinning cotton for the large establishments in the towns.

In the fifteenth century the counts of Toggenburg were among the richest and most powerful landholders in Switzerland. The line of the counts becoming extinct in 1636, they were succeeded by the barons of Rason as the next heirs: they indeed confirmed to the inhabitants the great privileges which had been granted to them by the last count of Toggenburg, but in 1469 sold the county to the abbot of St. Gallen. Unhappy differences ensued. The abbots wished to govern despotically, and the inhabitants to preserve their privileges, founded on the charter granted them in 1339, by count Donatus, and confirmed by Frederick, the last count, by which they were empowered to conclude after his death an alliance with the Swiss for the security of their rights. Such an alliance they afterwards concluded with the cantons of Glarus and Schwyz. The oppressive conduct of the abbots twice led to a sanguinary conflict. The first time was in 1712, when several of the cantons took part in the contest, which was ended, in 1718, by a convention concluded at Rorschach. Fresh conflicts arose in 1735-1759. At present Upper and Lower Toggenburg form the fourth and fifth districts of the canton of St. Gallen. Here are the little manufacturing town of Lichtensteig, which may be called the capital; and the small mountain-village of Wildhaus, 2010 feet above the Lake of Zürich, the birthplace of Ulrich Zwingli.

(Stein, *Geog. Lexicon*; Cannabich; Hörschelmann; Brockhaus, *Conversations Lexicon*.)

TOGRAI, or TOGHRAI, the surname of Abu Ismail Hosein Ben 'Ali Ben Mohammed Mowayyed ed-Din al-Issfahani, and the name by which he is commonly known. He was descended from Abu'l-Aswad ad-Doioli, one of the most celebrated of the companions of Mohammed, and was born at Ispahan in the fifth century of the Hejra, or the eleventh of the Christian æra, and gained great reputation as a poet. He was at first in the service of the celebrated Melek Shah (A.H. 465-485; A.D. 1073-1092) and his son Mohammed, the third and fifth sultans of Persia of the Seljukian dynasty; and he afterwards became vizir to Mas'oud, the son of Mohammed, and Sultan of Mosul.

When this prince revolted from his brother Mahmud, the seventh Seljukian Sultan of Persia, and was conquered in the battle at Esterabad near Hamadan, A.H. 514 (A.D. 1120), Tograi was taken prisoner, and was at first kindly treated by the conqueror. This however excited the jealousy of his vizir, Abu Talib 'Ali Ben Ahmed as-Semiremi, who caused Tograi to be secretly put to death, A.H. 515 (A.D. 1121), under the pretence of his being a heretic who believed the doctrines of the Molaheds or Ismaëlites, but in reality from fear of his talents. This is the account of his death given by Abulfeda ('Annal. Moslem.,' vol. iii., p. 417) and Ibn Khallekan ('Vit. Illustr. Viror.,' § 196, ed. Wüstenf.); that given by Leo Africanus ('De Vir. Illustr. Arab.,' cap. 13) is somewhat different. He was rather more than sixty lunar, or fifty-eight solar, years old at the time of his death. He appears to have enjoyed a great reputation, and was distinguished by several titles or surnames. The word *Tograi* is the name given to the person employed by the sultan to write on all the imperial decrees and proclamations his name and titles in a peculiarly large and flourishing character, which is called, from a Persian word, the *togra*; and from Tograi's skill in writing this, or perhaps from his celebrity as an author, he derived the title of 'Fakhr al Cottab,' or the Glory of Writers. His surname 'Al-monshi' signifies a person employed to draw up the letters written in the name of the prince; and that of 'Alostad' means the master or doctor.

The most celebrated of his poems, and the only one which has been published, is that entitled 'Lamiato 'l-'Ajam,' which he composed in Arabic at Bagdad, A.H. 505 (A.D. 1111-2). It derives its name 'Lamiat' from the circumstance that all the verses end with the letter *lam*, or *l*; and 'al-'Ajam,' that is, 'of the Persians,' is added to distinguish it from a celebrated Arabic poem written by Shanfara, and entitled 'Lamiato 'l-'Arab.' It is a poem of the elegiac kind, written in a plaintive style, and composed of distichs; and has been frequently published and translated. The first edition is that by the elder Pococke, Oxford, 1661, 8vo., with a Latin translation, and copious elementary notes. At the end of the volume is a treatise on Arabic prosody by Samuel Clerk, the University printer. There is an edition by Matthias Anchersen, with an unedited Latin translation by Golius, published in 1707, Utrecht, which is now exceedingly scarce, as almost all the copies were lost at sea. Tograi's poem was also published in Arabic, together with that by Shanfara, by H. A. Frähn, Casan, 1814, 8vo. It was translated into English by Leon Chappilow, Cambridge, 1758, 4to.; into French by Pierre Vattier, Paris, 1660, 8vo.; into German by Reiske, Friedrichstadt (Dresden), 1756, 4to. A fuller account of the editions and translations of this poem may be found in Schnurrer's 'Bibliotheca Arabica,' and Zenker's 'Bibliotheca Orientalis,' Leipzig, 1840, 8vo. Tograi also wrote a work on alchemy, entitled 'Directio in Usum Filiorum,' which title has been the occasion of D'Herbelot's making a great mistake as to the contents of the book.

(Schnurrer, *Biblioth. Arab.*; De Sacy's article on *Tograi*, in the *Biograph. Univers.*; Wüstenfeld, *Geschichte der Arabischen Aerzte und Naturforscher*, Göttingen, 1840, § 151, p. 87.)

TOISE, a French measure of six French feet, particularly used in all the older French measures of the earth. [WEIGHTS AND MEASURES.]

TOKAT, or TOCAT, a town of Asia Minor in 40° 16′ N. lat. and 36° 45′ E. long. The antient name of the place is supposed to have been Berisa: under the lower empire it was called Eudocia, and the same name is given to it by the Armenian writers. That it is not the site of Comana Pontica, as was formerly supposed, is now quite certain. Tokat is surrounded by hills, which enclose it on three sides, the only opening being to the north-east; a small stream runs through the town in the same direction, which joins the Tokat-Su (ancient Iris) a little below the city. The town is not walled; the streets are paved. The houses are all tiled (*i.e.* not flat-roofed), and the higher class of them built with unburnt bricks, but the greater part are merely wooden sheds, and give a mean appearance to the town. The streets are filthy and narrow; and from the eaves of the houses nearly meeting overhead, are very gloomy. Still some of the edifices are of good size, and parts of the town are tolerably neat for a Turkish city. Fires are frequent in Tokat. The luxuriant vegetation of the gardens in and near the town, the filthiness of the streets, and the abundance of fruit, occasion malignant fevers in summer and autumn. Tokat is under the Bey of Sivas. It is stated by Mr. Vice-Consul Suter to contain about 6730 families; of whom 5000 are Mussulmans, 1500 Armenians, 150 Greeks, 50 Jews, and 30 Roman Catholics. The place is the seat of an Armenian bishopric, and there are seven churches and thirty priests of that persuasion. The place has lost much of its former commercial importance, and the import trade is now limited to supplying the local consumption of the neighbouring villages. The merchants obtain what they require from Constantinople. There is an extensive dyeing establishment in which British calicoes and indigo are used; there is also an establishment for printing on cotton (by hand); the cloths are partly those of the country, but chiefly British muslins, of which many are thus required. Copper from the mines of Arghana is brought to Tokat to be refined; and there are manufactures of the raw silk brought from Amasia and other places.

(Mr. Vice-Consul Suter's *Notes on a Journey from Erzrúm to Trebizond*, in 'Geog. Journ.,' vol. x.; Smith and Dwight's *Researches in Armenia*.)

TOKAY is an ill-built town in the county of Zemplin, in Upper Hungary, on the river Bodrog, at its confluence with the Theiss. Tokay contains 4500 inhabitants, and has four churches,—one Roman Catholic, one Lutheran, one Calvinist, and one United Greek; one convent of Piarists and one of Capuchins. It is situated in 48° 7′ N. lat. and 21° 25′ E. long., at the foot of the Hegyalla, a chain of hills which is about 30 miles in length, from Szanto to Tornya, 8 or 9 in breadth, and the highest point 700 feet above the level of the sea. The whole of it, to the height of 250 feet, is planted with vines, which Bela IV. had brought to Hungary by Italian colonists; but the finest wine is produced on the small isolated hill called the Theresienberg or Mezes-Malé (honey from the comb). The greater part belongs to the crown: the other chief owners are Prince Bretzenheim, and the family of Szirmay. At the foot of the several vineyards of the Hegyalla the places are situated, the inhabitants of which are employed in the cultivation of the vine: the wines of Tallya, Tarczal, Zombor, Tollsva, and Mad, all which are in the neighbourhood of Tokay, are considered as the best. The whole produce is estimated at 150,000 to 200,000 eimer (the eimer in Upper Hungary is nearly 20 English wine gallons, not imperial gallons). All these wines of the Hegyalla are comprehended under the name of Tokay, though they differ a little in quality: those of Tokay and Tarczal are the finest. A great deal of wine which is sold as Tokay is produced in other parts of Hungary. The superiority of the wines of Tokay is owing partly to the climate and partly to the great care taken in the cultivation of the vines, in the selection of the grapes, and in the preparation of the wine. The vines are grown on the sides of the mountain, where ranges of stones are piled up, which protect the soil against torrents of rain, and, by reflecting the rays of the sun, greatly increase the heat. The ground is turned up with the spade three times in the season. Throughout this district the fully ripe grapes are gathered one by one, without throwing the bunches with the stalks, and the fruit, in the different stages of maturity, into the press, as in other parts of Hungary. The wine is of three sorts. 1. *The Essence.* The grapes being put into a barrel with holes at the bottom, their own weight presses out the juice, which is sweet and thick. 2. *The Ausbruch.* This wine is made from the grapes which have furnished the essence. On these grapes new wine of fresh grapes is poured, and a slight pressure applied. This wine is chiefly that sold abroad as Tokay; it has an aromatic flavour, and is not fit to drink till it is three years old. 3. *The Muslas*, or *Muschlas*, is obtained by pressure with the hands and the addition of new wine. The prices of the Essence and Ausbruch are very high in the country itself and at Vienna.

Tokay, though a small town, is a place of considerable trade, not only as being the centre of the wine trade, but likewise having great magazines of the salt of Marmaroz, which is exported to all parts of the kingdom. The annual fairs are much frequented. The vintage at Tokay gives occasion to a truly national festivity, at which great numbers of the nobles of the country are present. This fête affords the best opportunity of studying the character and manners of the several nations of which the population of

Hungary consists. The grave character of the Magyars is manifested even in their national songs, while those of the Germans and Slavonians are for the most part cheerful and gay.

(Jenny, *Handbuch für Reisende in dem Oesterreichischen Kaiserstaate;* Cannabich, *Lehrbuch der Geographie;* Stein, *Handbuch*, by Hörschelmann; Brockhaus, *Conversations Lexicon;* C. W. Röhrdauz and H. E. Lloyd, *European Commerce*.)

TOLAND, JOHN, was born on the 30th of November, 1669 or 1670 (it is not certain which), in the most northern part of the county of Londonderry, in the peninsula called Inis-Eogan, whence in one of his works, published with a Latin title, he called himself *Eoganesius*. Though it is not known who his parents were, it is known that they were Roman Catholics. He tells us of himself, 'Being educated from my cradle in the grossest superstition and idolatry, God was pleased to make my own reason, and such as made use of theirs, the happy instruments of my conversion.' (*Christianity not Mysterious*, Preface, p. viii.) And again, alluding, in his 'Apology' (p. 16), to a charge made against him that he was a Jesuit, he says that 'he was not sixteen years old, when he became as zealous against Popery as he has ever since continued. . . . Yet in Ireland that malicious report gained upon some few, because his relations were Papists, and that he happened to be so brought up himself in his childhood.' He was sent first to a school at Redcastle near Londonderry, where, we are told, that, having been christened Janus Junius, he was laughed out of this name by the boys, and took the name of John, which he ever after kept. He went in 1687 to the university of Glasgow, and after being there three years, to the university of Edinburgh, where he got a diploma as Master of Arts, in June, 1690. Shortly after this he went into England, where managing to gain the favour of some influential dissenters, he was sent by them to the university of Leyden to study, and prepare himself for the duties of a minister.

He stayed at Leyden about two years, and made the friendship of Le Clerc, Leibnitz, and other learned men, with whom he afterwards corresponded. On his return to England he went for some time to Oxford, where he employed himself chiefly in collecting materials on various subjects in the Bodleian library. The vanity of his character, and the ostentatious avowal of free-thinking on religion, appear to have made him conspicuous at Oxford, as they did everywhere else through the whole of his life. But in a reply to a letter of advice which he received here, he denied his being either an atheist or a deist. (*Collections of Several Pieces of Mr. John Toland*, &c., vol. ii., p. 302.)

At Oxford he began his 'Christianity not Mysterious,' which was published in London in 1696, the year after his leaving Oxford. The remainder of the title, viz., 'A Treatise showing that there is nothing in the Gospel contrary to reason nor above it, and that no Christian doctrine can be called a Mystery,' more fully explained the object of the publication. The work created a very considerable sensation, and elicited much attack and some persecution.

In 1697 Toland returned to his native country. Mr. Molyneux wrote to Locke, April 6th, 1697, from Dublin: 'In my last to you, there was a passage relating to the author of "Christianity not Mysterious." I did not then think that he was so near me as within the bounds of this city; but I find since that he is come over hither, and have had the favour of a visit from him. I now understand, as I intimated to you, that he was born in this country, but that he hath been a great while abroad, and his education was for some time under the great Le Clerc. But that for which I can never honour him too much is his acquaintance and friendship to you, and the respect which on all occasions he expresses for you. I propose a great deal of satisfaction in his conversation—I take him to be a candid free-thinker, and a good scholar. But there is a violent sort of spirit that reigns here, which begins already to show itself against him, and I believe will increase daily; for I find the clergy alarmed to a mighty degree against him; and last Sunday he had his welcome to this city, and hearing himself harangued against out of the pulpit by a prelate of this country.' (Locke's *Works*, vol. viii., p. 405, 8vo., ed. 1799.) Toland appears to have become acquainted with Locke; and this acquaintance he made the most of in conversation at Dublin. In Locke's reply to the bishop of Worcester, who, in defending the doctrine of the Trinity against Toland, had connected Locke with him, he showed that he did not reciprocate in an equal degree Toland's friendship and esteem for him. Mr. Molyneux wrote of him afterwards, May 27, 1697: 'Truly, to be free, I do not think his management, since he came into this city, has been so prudent. He has raised against him the clamour of all parties, and this not so much by his difference in opinion, as by his unreasonable way of discoursing, propagating, and maintaining it. . . . Mr. Toland also takes here a great liberty on all occasions, to vouch your patronage and friendship, which makes many that rail at him rail also at you. I believe you will not approve of this, as far as I am able to judge, by your shaking him off, in your letter to the bishop of Worcester' (p. 421). And Locke, on June 15, wrote what is worth quoting for itself, as well as for the opinion implied of Toland: 'As to the gentleman to whom you think my friendly admonishments may be of advantage for his conduct hereafter, I must tell you that he is a man to whom I never wrote in my life, and I think I shall not now begin: and as to his conduct, it is what I never so much as spoke to him of: that is a liberty to be taken only with friends and intimates, for whose conduct one is mightily concerned, and in whose affairs one interests himself. I cannot but wish well to all men of parts and learning, and be ready to afford them all the civilities and good offices in my power; but there must be other qualities to bring me to a friendship, and unite me in those stricter ties of concern; for I put a great deal of difference between those whom I thus receive into my heart and affection, and those whom I receive into my chamber, and do not treat them with a perfect strangeness' (p. 425). Pecuniary difficulties and persecutions together obliged Toland to leave Ireland in a very short time. The parliament at Dublin voted that the book should be burnt by the common hangman. Mr. Molyneux gives an account of his departure in another letter written to Locke.

He went to London, and, nothing daunted, published 'An Apology for Mr. Toland, in a Letter from himself to a Member of the House of Commons in Ireland, written the day before his book was resolved to be burnt by the Committee of Religion; to which is prefixed a Narrative containing the occasion of the said Letter.' He now devoted himself very vigorously to book-making of all sorts, in politics, theology, literature; showing always, even in the pamphlets which the mere passing occasions called forth, a degree of genius and erudition deserving of a better fate than his very scanty and precarious earnings. He published in 1698 a pamphlet, just after the Peace of Ryswick, when there arose the question what forces should be kept on foot, entitled, 'The Militia Reformed, or an easy scheme of furnishing England with a constant Land Force, capable to prevent or to subdue any foreign power, and to maintain perpetual quiet at home, without endangering the public liberty;' and in the same year his 'Life of Milton,' which was prefixed to 'Milton's Prose Works,' in 3 vols. folio. Then came, in 1699, the 'Amyntor, or a Defence of Milton's Life,' in answer to a criticism of Dr. Blackall, bishop of Exeter, on some incidental remarks made by him in his 'Life of Milton' on the genuineness of some parts of Scripture. There followed in rapid succession his editions of Holles's 'Memoirs,' and of Harrington's Works, with a Life of Harrington prefixed; 'Clito,' a poem on the force of eloquence; 'Anglia Libera, or the Limitation and Succession of the Crown of England explained and asserted,' and other political pamphlets. The 'Anglia Libera' was published in 1701, on the passing of the act which settled the crown on the Princess Sophia of Hanover and her heirs, after the death of William, and of Anne without issue; and Toland went over to Hanover and managed to get presented to the electress by the earl of Macclesfield, who had been sent on a special mission to carry the act to the electress, and then presented his 'Anglia Libera' to her with his own hands. He afterwards stayed in Hanover for some short time, and went from thence to the court of Berlin, acting at these courts apparently as a sort of political agent, and making the most of the recommendations which he carried from the English government to extend his reputation for literature and learning. He won the good opinion both of the Princess Sophia and of the queen of Prussia; they both courted his conversation, and afterwards his correspondence. On the occasion of his first visit to Berlin he held a theological discussion with Beausobre in the presence of the queen, who acted as a sort of moderator, and closed it, on observing that the disputants were beginning to lose their temper. His letters to Serena, published in 1704, were addressed to the queen of Prussia.

In 1702, in an interval of his residence abroad, he published 'Vindicus Liberius, or Mr. Toland's Defence of himself against the Lower House of Convocation and others.' In this work his opinions have assumed a very subdued tone, which is perhaps to be accounted for in a great measure by the prospect of political advancement which seemed to be opening for him. 'Being now arrived to years that will not wholly excuse inconsiderateness in resolving, or precipitance in acting, I firmly hope that my persuasion and practice will show me to be a true Christian, that my due conformity to the public worship may prove me to be a good churchman, and that my untainted loyalty to King William will argue me to be a staunch commonwealth's man.' Subsequent theological works showed this to have been a moderation merely assumed for the time.

The mask of orthodoxy was thrown off in a pamphlet which he published in 1705, in the title of which he did not scruple to designate himself a Pantheist: 'Socinianism truly stated, being an example of fair dealing in theological controversies; to which is prefixed Indifference in disputes recommended by a Pantheist to an orthodox friend.' But he was now enjoying the zealous patronage of Harley, afterwards earl of Oxford, who had in the previous year become secretary of state, and he probably thought he could again afford to be a free-thinker. Harley employed him to write several political pamphlets, and sent him abroad again in 1707, to Germany and Holland. The nature of his connection with Harley may be gathered from the following extract from one of his 'Memorials to the Earl of Oxford,' which are printed in a posthumous collection of his pieces written at a time when the zeal of his patron had cooled:—'I laid an honester scheme of serving my country, your lordship, and myself; for seeing it was neither convenient for you nor a thing at all desired by me, that I should appear in any public post, I sincerely proposed, as occasions should offer, to communicate to your lordship my observations on the temper of the ministry, the dispositions of the people, the condition of our enemies or allies abroad, and what I might think most expedient in every conjuncture; which advice you were to follow in whole, or in part, or not at all, as your own superior wisdom should direct. . . . As much as I thought myself fit, or was thought so by others, for such general observations, so much have I ever abhorred, my lord, those particular observers we call spies; but I despise the calumny no less than I detest the thing.' (vol. ii., p. 223.) Toland was abroad on this occasion for about three years, acting as a sort of political spy for Harley, though he disavowed the name, and eking out his subsistence by his pen, and apparently in any way that presented itself. He made a trip from Holland to Vienna, commissioned by a wealthy banker to procure for him from the imperial ministers the rank of a count of the empire; but he did not succeed in attaining the object of his mission. He managed in Holland to ingratiate himself with Prince Eugene, who was very attentive and liberal to him. In the 'Memorial' to the Earl of Oxford, which has been before quoted, Toland mysteriously connects this prince with his mission to Vienna, and cunningly tries to give this foolish journey a character of great dignity and honour. 'My impenetrable negotiation at Vienna, hid under the pretence of curiosity, was not only applauded by the prince that employed me, but also proportionably rewarded' (p. 225). In due time he quarrelled with Harley, and then wrote pamphlets against him. As a Whig pamphleteer, he had the honour of Swift's notice in 'Toland's Letter to Dismal.'

The principal publications of Toland which remain to be mentioned are the following, with the dates of their appearance:—a volume published at the Hague in 1709, containing two Latin essays, with the titles 'Adeisidæmon, seu Titus Livius à Superstitione Vindicatus,' and 'Origines Judaicæ, seu Strabonis de Moyse et Religione Judaica Historia brevitèr illustrata;' 'The Art of Restoring, or the Piety and Probity of General Monk in bringing about the last Restoration, evidenced from his own Authentic Letters, with a just account of Sir Roger, who runs the parallel as far as he can' (by Sir Roger was meant the earl of Oxford, his former patron, who was then plotting the restoration of the Pretender); and 'A Collection of Letters by General Monk, relating to the Restoration of the Royal Family,' both published in 1714; 'Reasons for Naturalizing the Jews in Great Britain and Ireland, on the same footing with all other nations, with a Defence of the Jews against all Vulgar Prejudices in all Countries,' published in 1714; 'The State Anatomy of Great Britain, containing a particular account of its several Interests and Parties, their bent and genius, and what each of them, with all the rest of Europe, may hope or fear from the reign and family of King George,' which work called forth several answers, that led Toland to publish a second part; 'Nazarenus, or Jewish, Gentile, or Mahometan Christianity, containing the History of the Antient Gospel of Barnabas, and the Modern Gospel of the Mahometans, attributed to the same Apostle, this last gospel being now first made known among Christians: also the original plan of Christianity, occasionally explained in the Nazarenes, whereby divers controversies about this divine (but highly perverted) institution may be happily terminated; with the relation of an Irish manuscript of the four gospels, as likewise a summary of the antient Irish Christianity, and the reality of the Keldees (an order of lay religious), against the two last bishops of Worcester,' which appeared in 1718; 'Pantheisticon, sive Formula celebrandæ Sodalitatis Socraticæ, in tres partes divisa, quæ Pantheistarum sive sodalium continent, 1, Mores et axiomata; 2, Numen et philosophiam; 3, Libertatem et non fallentem legem neque fallendam: Præmittitur de antiquis et novis eruditorum sodalitatibus, ut et de universo infinito et æterno, diatriba. Subjicitur de duplici Pantheistarum philosophia sequenda, ac de viri optimi et ornatissimi idea, dissertatiuncula,' published in 1720; and in the same year, 'Tetradymus;' and in 1721, 'Letters from the Right Honourable the late Earl of Shaftesbury to Robert Molesworth, Esq., now Lord Viscount of that name; with two letters written by the late Sir John Cropley.'

Some of these titles show at once the learning and the fantastical pedantry of Toland. The 'Tetradymus' consists of four treatises, which bear the names Hodegus, Clydophorus, Hypatia, and Mangoneutes, and have for their respective subjects the pillar of cloud and fire which led the Israelites, and which Toland argues was no miracle; the exoteric and esoteric philosophy of the antients; an account of the female philosopher Hypatia, 'who was murdered at Alexandria, as was supposed, at the instigation of the clergy;' and an answer to Dr. Mangey, who had attacked his 'Nazarenus.' The 'Nazarenus' and the 'Pantheisticon' had again evoked the anger of the church. Dr. Hare, dean of Worcester, in a treatise against Hoadley, spoke of Toland as often quoting Locke to support notions he never dreamed of. Toland published an advertisement to the effect that he had never quoted or even named Locke in his writings. Hare issued a counter-advertisement, in which he directs 'makes great use of Mr. Locke's principles' to be read instead of 'is often quoted to support notions he never dreamed of.' Toland then published a pamphlet, with the title 'A Short Essay upon Lying, or a Defence of a Reverend Dignitary, who suffers under the Persecution of Mr. Toland, for a *lapsus calami*.' This pamphlet, with Hare's advertisement, was reprinted at the end of the 'Tetradymus.' Hare returned to the charge, and, in the preface to a new edition of his work, speaks of 'downright Atheists,' such as the impious author of the 'Pantheisticon.'

Towards the close of his life, Toland, whom all his literary industry could not keep from pecuniary difficulties, found a benefactor in Lord Molesworth. Mr. D'Israeli, who has devoted a chapter to Toland in his 'Calamities of Authors,' mentions, from Toland's papers which he has seen, the paltry sums which he generally received for his writings. 'For his description of Epsom he was to receive only four guineas in case 1000 were sold. He received ten guineas for his pamphlet on Naturalising the Jews, and ten guineas more in case Bernard Lintott sold 2000.' And in another place, in the 'Quarrels of Authors,' in the chapter headed 'Lintott's Account-Book,' he says, 'It appears that Toland never got above 5*l.*, 10*l.*, or 20*l.* for his publications. . . . All this author seems to have reaped from a life devoted to literary enterprise, and philosophy, and patriotism, appears not to have exceeded 200*l*.' This last statement must be an exaggeration. Further details as to Toland's literary gains, derived also from Lintott's Account-Book, are to be found in Nichols's 'Literary Anecdotes,' vol. v., p. 302.

Toland died at Putney, where he had lodged for about four years previous, choosing that place on account of its convenient distance from London, on the 11th of March, 1722. 'Never,' says Mr. D'Israeli, 'has author died more in character than Toland: he may be said to have died with a busy pen in his hand. Having suffered from an unskilful physician, he avenged himself in his own way; for there was found on his table an "Essay on Physic without Physicians." The dying patriot-trader was also writing a preface for a political pamphlet on the danger of mercenary parliaments; and the philosopher was composing his own epitaph, one more proof of the ruling passion predominating in death; but why should a Pantheist be solicitous to perpetuate his genius and his fame?'

Toland's posthumous works were published in 1726, in 2 vols. 8vo., with a Life by Des Maizeaux prefixed, and were republished in 1747. The contents of these two volumes are an additional proof of the versatility of his powers: they contain, together with many other essays, the Memorials to the Earl of Oxford which have been referred to, and several private letters; an account of Giordano Bruno; the Secret History of the South-Sea Scheme, in which Toland had been concerned; a Plan for a National Bank; and a proposal, in Latin, for a new complete edition of Cicero.

'An Historical Account of the Life and Writings of the late eminently famous Mr. John Toland, by one of his most intimate friends, in a letter to the Lord ———,' was published in 1722; and is attributed to Curll. This is not so minute a biography as Des Maizeaux's, and is rather a sketch of his writings and opinions. There is appended to it a complete list of Toland's works, many of the smaller of which are not named in this article.

Toland's works have never been collected, and the notoriety which attended him during his life having soon died away, they are now little known. But they are almost all of some worth, and his political writings may throw some little light on the history of the times.

TOLE'DO, a province of Spain, formerly part of New Castile, but now a separate province. It is divided into three large districts, Toledo, Ocaña, and Talavera, comprising 282 towns and hamlets. Its boundaries are, to the north the province of Madrid; to the east that of Cuenca; to the south La Mancha; to the west Estremadura; and to the north-east the province of Avila. It covers a surface of 734 square leagues (Spanish), and is watered by five rivers, the Tagus, the Tajuña, Rio Ansares, Guadarrama, and Alverche, besides other inconsiderable streams. A chain of lofty mountains, called 'Los Montes de Toledo,' intersects it from east to west.

TOLE'DO (*Toletum*), a large city of Spain, and the capital of the province of that name, is situated on a rocky eminence surrounded by the Tagus, except on the northern side, in 39° 52′ N. lat., 4° 11′ W. long. It is a very antient city. Pyrrhus, one of the fabulous kings of Spain, is sometimes called the founder. Its origin is also attributed to some Jews who migrated to Spain during the period of the second temple in Jerusalem, and who called it Toledoth, *i.e.* genealogies; because they say the exiles there reviewed their family genealogies when they assembled to dig the wells and found the city. In support of the latter opinion many towns are pointed out in the province of Toledo which retain to this day the names given to them by their Hebrew settlers, such as Escalona, from Ascalon; Noves, from Nove; Maqueda, from Megiddo; Jepes, or Yepes, from Joppa, &c. Toledo was a city of some importance under the Romans, who made it a colony. In A.D. 577, Leovigild, king of the Goths, transferred the seat of his empire from Seville to Toledo. It was also greatly enlarged and embellished by Wamba, who surrounded it with walls. The city was taken by the Arabs under Tárik Ibn Zeyyád, in A.D. 712 (April), after the celebrated battle of Guadalete, which opened the gates of the Peninsula to the Moslems. Under the Arabs, Toledo was a city of the first rank, second to none but Cordova, the capital of the Mohammedan empire. Its motley population, composed of Arabs, Berbers, Jews, and Christians, which last were denominated Most'arabs, or Mozárabes [MUZARAB], were often in open revolt against the khalifs of Cordova. At the breaking up of the empire of the Beni-Umeyyah, and when the governors rose in the provinces and declared themselves independent of the capital [MOORS], the whole of New Castile and a portion of the old was formed into a kingdom by a powerful chieftain named Ibn Yaysh. At his death he was succeeded by Isma'íl Ibn Dhí-n-nún, and this latter by Yahya Ibn Dhí-n-nún, surnamed Al-mámún, an able and enterprising monarch, who became the patron of science, and added Valencia, Cordova, and other large cities to his hereditary dominions. His son Yahya, surnamed Al-kádir-billah, succeeded him in 1075, but in the year 1083 Alfonso VI. of Castile and Leon invaded his dominions, and, after reducing all the fortresses and towns round Toledo, took possession of that city on the 25th of May, A.D. 1085. Alfonso having assumed on the occasion the title of emperor of Toledo, the city was thenceforward 'Real é Imperial' (Royal and Imperial). During the civil wars between Peter the Cruel and his bastard brothers Don Fadrique and Don Enrique (1354-69), Toledo was often taken and retaken, and the population, which consisted chiefly of Jews, submitted to all kinds of ill-treatment from the conquerors.

Toledo is the see of an archbishop, who is the primate of all Spain, and has the title of 'Canciller de Castilla. The bishoprics of Cordova, Cuenca, Siguenza, Jaen, Segovia, Cartagena, Osma, and Valladolid are its suffragans. It was formerly the richest see in all Spain, but the revenue is now greatly diminished. Some of the greatest men that Spain has produced have been archbishops of Toledo, as Rodrigo Simon de Rada, Ximenez de Cisneros, Gil de Albornoz, Mendoza, Tavera, Lorenzana, &c. The cathedral is the largest in Spain, and is by some considered the finest; for although, owing to its having been built at different periods, it does not present that uniformity of style which might have been desired, it is nevertheless exceedingly interesting in its details. It stands on the site of the old Moorish mosque, and the foundations were laid, in 1258, by Ferdinand III. of Castile, afterwards canonized by the church of Rome, and Rodrigo Ximenez, at that time archbishop of Toledo. It consists of five naves, and measures 404 feet in length and 204 in width. The naves are supported by eighty-four colossal pillars and the whole church is paved with white and blue marble. Some of the chapels are exceedingly beautiful. La Capilla Mayor (great chapel), which was enlarged by Cardinal Ximenez, contains the mausoleums of Alfonso VII., Don Sancho el Deseado, Don Sancho el Bravo, the Infante Don Pedro, son of king Alfonso VIII., and lastly that of Cardinal Don Pedro de Mendoza, which last is surrounded by a most beautiful plated iron railing. The chapel of Santiago, where the celebrated Don Alvaro de Luna and his wife Doña Juana Pimentel are buried; that of San Ildefonso, Nuestra Señora del Sagrario, and Reyes Nuevos—which last contains the tombs of Enrique II., Juan I., Enrique III., and their wives—are all deserving of notice for their architecture, and the profusion of exquisite marble and carvings in wood with which they are decorated. Another chapel, called Capilla Muzarabe, because mass is still said daily according to the Muzarabic ritual, is a great curiosity of its kind. It was founded, in 1510, by Cardinal Ximenez. The cathedral of Toledo was formerly celebrated for its jewels and its silver and gold ornaments. There was once, among other relics, a figure of massive gold representing San Juan de las Viñas, and also a petticoat of Our Lady embroidered with pearls and rubies, said to be of inestimable value. Most of them however disappeared during the Peninsular war, and what remained has lately been disposed of by the government. Annexed to the cathedral is the archbishop's palace, which contains a very fine library, rich in old manuscripts. Besides the cathedral, Toledo has other splendid buildings, among which the following are the principal:—The convent and church of San Juan de los Reyes, built, in 1476, by Ferdinand and Isabella, in commemoration of the victory gained over the Portuguese at Toro in 1476. At a later period the manacles and fetters worn by the Christian captives of Granada, liberated at the taking of that city in 1492, were suspended to the outside walls of the building, where they are to be seen to this day. The church and the cloister, built in the richest Gothic, are particularly admired. The foundling hospital of Santa Cruz, founded by Cardinal Mendoza in 1304; that of St. John the Baptist, called also 'el Hospital de afuera,' because it stands outside the city walls, built and richly endowed by Cardinal Tavera; San Juan de la Penitencia, which is a foundation of Ximenez,—all will afford subject of study to the artist. La Iglesia del Transito, which was formerly a Jewish synagogue, built during the reign of Peter the Cruel, at the expense of his treasurer, Samuel Levi, is a curious specimen of Saracenic architecture. The same may be said of another church, called Santa Maria la Blanca, which was once a Moorish mosque..

The Alcazar, or royal palace, stands on an eminence, at the foot of which flows the Tagus. It was built by Alfonso X. on the site of the Moorish palace, and was almost entirely rebuilt by Charles V., who employed the best Spanish architects of his time. His son, Philip II., made also considerable additions to it, which were principally directed by his chief architect, Herrera, who designed the Escurial. At present it is in a very dilapidated state, and unless it is speedily repaired, it will soon be a heap of ruins. A lunatic asylum, called 'el Nuncio nuevo,' and the 'Universidad Literaria,' are the only two modern buildings of note. Both were erected about the end of the last century by an enlightened archbishop, named Lorenzana. At a short distance from the city, on the right bank of the Tagus, are shown the ruins of a Moorish building, which the people of the country call 'Los Palacios de Galiana:' it was formerly a country villa belonging to the Moorish rulers of Toledo. Of the two bridges on the Tagus, that of Alcantara was built by the Arabs. It consists of only one arch, which spans the whole stream. The streets of Toledo are very narrow and crooked, like those of most Moorish-built cities of the Peninsula. The houses, which are built in the Moorish style, have generally only one or two stories; and the apartments are arranged round a court, over which an awning is thrown. In this court, which is frequently ornamented with a fountain and flowers, the family usually sit in summer-time. The environs of the city are barren and unproductive, but the neighbouring mountains contain some green valleys, where the wealthy inhabitants have their country-houses, called *cigarrales*. During the fifteenth and sixteenth centuries Toledo was celebrated for its manufactory of sword-blades, as well as for its silks: the fabrication of the former still continues under the patronage of the government; but of the latter, not one loom remains in operation. The population of Toledo, which in the sixteenth century exceeded 100,000 inhabitants, does not amount now to 12,000. There are several histories of Toledo, among which the most esteemed are, 'Descripcion de la imperial Ciudad de Toledo, y Historia de su Antiguedad y Grandeza,' Toledo, 1605, 4to., reprinted in 1617; Roxas, 'Historia de la imperial y nobilisima Ciudad de Toledo,' Mad., 1654-63, fol.; Alcozer, 'Historia de Toledo,' 1554, fol.; a Jesuit, named Roman de la Higuera, well known as the forger of the chronicles of Luitprand and Dextrus, wrote also a history of Toledo in several volumes, which is preserved in manuscript in the Royal Library at Madrid.

(Miñano, *Diccionario Geográfico*, vol. viii., p. 444; and the historians above named.)

TOLE'DO, DON PEDRO DE, a younger son of Frederic of Toledo, duke of Alba, was born at Alba de Tormes, near Salamanca, in 1484. After going through his early studies he was placed as a page in the court of King Ferdinand the Catholic, who took him into particular favour; and it was by the king's influence that young Pedro obtained the hand of Donna Maria Osorio, heiress of the house of Villafranca, in consequence of which he took the title of Marquis of Villafranca, and the possession of the rich estates attached to it. He afterwards served with distinction in the expedition against Jean d'Albret, king of Navarre, and after King Ferdinand's death he continued in the service of his successor Charles I. of Spain, afterwards Charles V. of Germany. He served against the revolted communeros of Castile, and afterwards followed the court of Charles V., whom he accompanied in his journeys through Flanders, Germany, and Italy. In 1532, being at Ratisbon with the emperor, the news arrived of the death of Cardinal Colonna, viceroy of Naples, when Charles V. appointed for his successor Don Pedro de Toledo, marquis of Villafranca, who immediately set out to take possession of his government. He found the kingdom suffering from the consequences of the preceding foreign and civil wars, and especially of the recent French invasion of 1527-29, and the revolt of many of the barons and the subsequent confiscation of their property; of the plague, which, originating in the French camp, had desolated the city of Naples; and the state of confusion, bordering upon anarchy, which prevailed in the provinces. The first care of the new viceroy was to enforce the rigorous administration of justice without respect for persons, and he sent to the scaffold the commendator Pignatelli, the count of Policastro, and other noblemen, who had been guilty of oppression and other crimes. He pulled down the old dark arcades and other places which were the resort of thieves and murderers; he abolished the abuse of making the palaces of the barons a place of asylum for criminals; forbade the use of weapons, except the side sword, then worn by gentlemen; he sentenced duellists to death, prescribed regulations for restraining the disorders that took place at funerals and marriages; and, lastly, by a 'bando,' or public edict, he inflicted the penalty of death on any one found in the night with ladders scaling the windows of houses, a practice which had become frequent among dissolute men, who thus introduced themselves into ladies' apartments. Don Pedro reformed the courts of justice, increased the number of judges, and made several regulations for the more humane treatment of prisoners and debtors; and also for the prevention of bribery and perjury. He raised an extensive building near Porta Capuana, where he placed all the higher courts of justice, civil and criminal.

When Charles V., on his return from the Tunis expedition in 1535, visited Naples, where he remained till March, 1536, amidst the festivals and rejoicings with which he was greeted, he received hints and suggestions from several of the nobility against Toledo, but Charles stood firm in his good opinion of the viceroy, especially after having heard the deputies of the people, who explained to him that the nobility disliked Don Pedro because he would not permit them to oppress the lower orders, and to put themselves above the law, as they had been wont to do. It is reported that Charles, when he landed at Naples, on meeting the viceroy, said to him, 'Welcome, marquis; I find that you are not become so large as I was told you were;' to which Toledo replied, smiling, 'Sire, I am aware that you have been told that I was grown a monster, which I am not.'

Toledo greatly embellished Naples; he enlarged the city, extended the walls, cleared, widened, and paved the streets, and made new drains and sewers; he built the royal palace near Castel Nuovo, which is now called 'Palazzo Vecchio,' and constructed the handsome street which still bears his name. He adorned the city with fountains, enlarged the dockyard, fortified the castle of S. Elmo, built new hospitals and churches, and, in short, he quite altered the appearance of Naples. He also drained the neighbouring marshes by opening the wide canal called dei Lagni, which carries the superfluous waters into the sea.

In 1537, the Turks having landed at Castro and other places of the province of Otranto, Toledo summoned the barons with their militia, and marched with them and the regular Spanish troops against the enemy, who, finding the country prepared for defence, took again to their ships and sailed away. Toledo fortified the maritime towns of Apulia, built towers of defence along the coast, restored Pozzuoli, which was nearly depopulated in consequence of the earthquakes and volcanic eruptions, and enlarged the 'Grotta,' which leads to it from Naples. For all these and other services to the Neapolitans, as well as for the just though severe tenor of his general administration, Don Pedro de Toledo had become very popular, until the year 1547, when his ill-judged attempt to establish the tribunal of the Inquisition after the fashion of his own country, Spain, rendered him universally obnoxious. The cause of this attempt was that the doctrines of the Reformation had found their way to Naples, and made many converts, even among priests and monks. Charles V., who was at that time struggling in Germany with the religious and political dissensions arising out of the Reformation, dreaded a similar explosion in his Italian dominions, and the viceroy Toledo wished to save his master the additional trouble. Pope Paul III. was anxious to assist them in repressing the spread of heresy to Italy: but the Neapolitans, a lively, communicative people, had conceived a great horror of that gloomy and arbitrary court and its secret proceedings; they had heard of its deeds in Spain, and they determined to resist its introduction into their country, even by force of arms if necessary. The tumult began about the middle of May, when the people tore down the placards containing the edict which sanctioned the establishment of the Inquisition, from the gates of the archbishop's palace. A cry of 'To arms!' resounded through the streets and squares; most of the nobles, who hated Toledo for their own reasons, joined the citizens in their resistance. The people turned out some of their municipal magistrates, whom they suspected of being for the viceroy, and elected others without the viceroy's sanction; and Toledo having resented this proceeding, the people took up arms, and attacked the Spanish soldiers who garrisoned the castles. The Spaniards fired with cannon into the city, and the people cut down all Spaniards whom they found straggling. The viceroy, having seized some of the head rioters, caused them to be summarily executed, which added fuel to the flame, and the citizens and nobles formed themselves into a union or patriotic convention, taking for their motto, 'For the service of God, the emperor, and the city of Naples;' stigmatising as traitors to their country those who did not join the union. The union sent as envoys to Charles V. the prince Sanseverino and another nobleman, refusing meantime obedience to the viceroy, who remained in the castle with his Spanish soldiers and a few Neapolitan adherents, and the town was without any regular government. Frequent skirmishes took place in the streets between the viceroy's men and the people; many individuals were killed, and houses were plundered. At last the answer came from Charles V., commanding the citizens to lay down their arms, with secret instructions to the viceroy to proceed leniently and prudently in the matter.

On the 12th of August Toledo signified to the deputies of the city the will of the emperor that the Inquisition should not be established in Naples; that the past should be forgotten, except as to some of the principal leaders of the insurrection, who were obliged to emigrate; and that the city should pay one hundred thousand crowns as a fine. And thus this serious affair was hushed up, but the Neapolitans gained their point, and the tribunal of the Inquisition was never established at Naples, though persons accused of heresy were tried by the common ecclesiastical court, and several of them were put to death by the concurrence of the lay power. The prince Sanseverino, who had displeased Charles V., thought it prudent to emigrate to France, and was outlawed. [TASSO, BERNARDO.]

In July, 1552, a large Turkish fleet, under Dragut Raïs and Sinan Pasha, anchored near Procida, at the entrance of the Bay of Naples, when the emigrant prince Sanseverino of Salerno was to have joined them with a French squadron; but the viceroy, it is said, by means of a large bribe, induced the Turkish commanders to leave the coast before the arrival of the French.

Towards the end of the same year the viceroy, although old and infirm, was desired by Charles V. to march to Siena in Tuscany, which republic had thrown off the protection of the emperor and admitted a French garrison. Don Pedro having sent most of the troops by land, embarked with the rest for Leghorn. On arriving there he fell seriously ill, and was removed to Florence. The duke Cosmo de' Medici had married his daughter Eleonora. He expired at Florence, in February, 1553, after having administered the kingdom of Naples for more than twenty years. He is by far the most distinguished in the long list of the Spanish governors of Naples, and one of the few who are still remembered with feelings of respect by the Neapolitans.

(Giannone, *Storia Civile del Regno di Napoli;* Botta, *Storia d'Italia.*)

TOLE'DO, TABLES OF. The Moors brought astronomy into Spain at the beginning of the eleventh century, and about the year 1080 tables were calculated for the meridian of Toledo, by Arzachel. Of these tables there was no specific account till the time of Delambre, and no printed publication of them has ever been made. It was usual to state that they were intended as an improvement on the tables of Albategnius, that their character never was very high, and that the Alphonsine Tables [ALONSINE TABLES] were intended as an improvement upon them. Delambre (*Hist. Astron. Moyenne*, p. 175) examined two manuscript Latin translations of the tables, which he found in the Royal Library at Paris; and his report of their contents is what might have been expected. The theory and numerical quantities employed are in almost every instance those of Ptolemy, and there is only just enough of original observation to establish the fact that the Toledine observers were very bad ones.

TOLENTI'NO. [MACERATA.]

TOLERATION, TOLERANCE. The latter of these two words more commonly expresses a feeling or habit of mind, and the former an overt act, or a realization in greater or less degree of the feeling in the institutions of a political society. This distinction is not always strictly observed, but will be found generally a correct one. The word *tolerance* suggests a consideration of the feeling, in its moral aspect of a virtue; while the word *toleration* opens out for discussion the political questions of the toleration of opinions on government, morals, and religion, by the governing power in a state, and more especially of religious toleration.

The virtue of tolerance in an individual, and the duty of toleration by the governing power in a state, depend, to a great extent, on the same principles. The general reasons for the one and for the other are the same, and so are the general reasons for the limits to both; but the fields within which toleration is to be exercised by a private individual and by the governing power in a state, and within which the respective exceptions arise, are different; and while the rule of private tolerance is simple and comprehensive, and of uniform application, the extent of state-toleration and the modes of its exercise must necessarily vary with the varying circumstances of political societies.

The duty of one individual towards another is to be tolerant of every action honestly meant and every sincere opinion. Actions which proceed from bad motives, and opinions which are not put forth in truthfulness and for truth's sake, every individual is called upon to reprobate, without reference to the tendency of the action or of the opinion itself, but for the motive, which is inimical to general happiness. [MORALS.] Motives then, which are moral habits or dispositions, are the grounds of tolerance or intolerance between individuals. The governing power in a state, on the other hand, has to consider actions and opinions in themselves, and without reference to the motives in which they may originate. This is indeed the fundamental distinction between the provinces of morals and legislation; that of the first embracing motives or dispositions, and that of the second, overt acts. The private individual then is required to be tolerant of all actions and opinions, save those that proceed from vicious motives. The governing power in a state is required to tolerate all actions and opinions, save those that have a tendency detrimental to the general happiness, which it is the business of that governing power to watch over and to promote to the utmost. In both cases, tolerance as a general rule, and the respective exceptions, are dictated by that which is the fundamental principle alike of morals and of politics, and which is now understood by every one, whether he approve or object to the name, under the name of the greatest-happiness-principle. It is assumed that the faculties of thought, of feeling, and of action, with which man has been endowed by God, have been given to be exercised, and with a design that their exercise should conduce to the happiness of individuals and of mankind. Any exercise of these faculties by an individual which has a contrary tendency, the moral affections of his fellow-men revolt at; and men deal out to one another disapprobation of injurious feelings and motives, and support with their opinion the governing power, to which they yield political obedience, in the repression of injurious acts and injurious publications of opinion. Thus do the feelings of men operate to turn back the gifts of Providence, which are used in a manner contrary to his purpose, to their original design. But apart from moral disapprobation of injurious motives and dispositions, and from the repression of injurious acts and injurious publications of opinion, by the governing power in a state, the great end of human happiness requires the fullest freedom of thought and action. An individual should be tolerant of all honest differences of opinion for the sake of truth, which is best promoted by discussion, and the promotion of which promotes human happiness; and for the sake of peace and of the maintenance of kindly and friendly feelings, which not only conduce directly to happiness, but indirectly also to the improvement of the moral character, both of him who practises tolerance, and of him towards whom it is practised. Peace, friendship, and the proper development of the moral dispositions, enjoin also the tolerance among individuals of honestly meant actions. And as to the conduct of the governing power in a state, the cause of truth and the principle that the exercise of the faculties which God has given must, as a general rule, conduce to good, require that every action and expression of opinion should be tolerated, save those which clearly contravene the happiness of the members of the particular political society.

The scope of tolerance among individuals, as applied to opinions, has been well defined by Mr. Bailey, in the following passage from his admirable 'Essays on the Formation and Publication of Opinions:'—'True liberality consists in not imputing to others any moral turpitude because their opinions differ from our own. It does not consist in ostensibly yielding to the opinions of others, in refraining from a rigorous examination of their soundness, or from detecting and exposing the fallacies which they involve, but in regarding those who hold them as free from consequent culpability, and abstaining from casting upon them that moral odium with which men have been ready in all ages to overwhelm such as deviated in the least from the miserable compound of truth and error which they hugged to their own bosoms.' The importance of cultivating the virtue of tolerance in the education of individuals cannot be overrated. In a political society in which the bulk of the community possess power, or in which they influence indirectly a government that is not in itself democratic, and that requires the control of a wise public opinion, the degree to which the duty of toleration is acted up to by a state will greatly depend on the degree to which tolerant feelings prevail among its individual members.

It is the duty of the governing power in a state to tolerate all actions and opinions save those which have a tendency contrary to the happiness of its members. The practical question then to be solved is, What are the cases of exception? what are the actions and opinions which it is the duty of the governing power in a state to repress? The proper solution of this question will be necessary for any particular state, that its duty of toleration may be properly fulfilled. In the case of each particular state, there will be particular circumstances entering into this question. But it is obvious that we must here content ourselves with a general answer to the question.

It is the first duty of every government to protect, to the utmost of its power, the persons and the property of all and each of its subjects, and to repress all injuries to these. It follows that it should prevent the diffusion of opinions calculated to suggest or encourage such injuries. It may often be a question, as with all other opinions which it is desirable to repress, whether active steps for the purpose may not rather have the effect of extending than of contracting the circulation of the obnoxious opinions; but this is a matter of prudence, which does not affect the question of the desirableness of repressing such opinions, and of the duty of the state to pursue what may be the best method of repression.

It is the duty of the governing power in a state also, watching over and availing itself of every means to forward the moral welfare of its members, to repress immoralities, whether of action or of published opinion. The same question will occur, as in the former case, as to whether prosecution in many cases will not thwart rather than forward its object; but to abstain from prosecuting on the ground of prudence is not to tolerate, and there will be no dispute as to the propriety of excepting from toleration in a state, open acts of lewdness and indecency, the exhibition of indecent prints, immoral books, &c.

We come now to cases which present more difficulty, and in which there is more scope for the modifying influence of differences in form of government and in other circumstances of political societies, viz. the cases of opinions on government and on religion. The degree to which differences of opinion on these subjects are to be tolerated is, in all states, a question of very great importance, and into which, in almost every different state, some peculiar elements enter.

It may be stated generally however, that the maintenance of an existing government, or its protection against overthrow or rebellion, is required for the happiness of those who are under it, and that it will be the duty of the governing power to prevent acts tending to its own overthrow, or opinions likely to excite such acts. In different forms of government, the degrees to which for this purpose freedom of action and of opinion will be abridged will be different. The maintenance of a despot's power will require more extensive and more stringent restriction than the maintenance of a government in which a large portion of the community have a part. The degree to which restriction is required by a form of government will be an important point in the consideration of its goodness as a form of government; but there can be no question as to the duty of the governing power to impose the amount of restriction necessary for its own safety. 'Disobedience to an established government, let it be never so bad, is an evil; for the mischiefs inflicted by a bad government are less than the mischiefs of anarchy.' (Austin's *Province of Jurisprudence Determined*, p. 54.) But it will be a question, and in the cases of all governments open in any degree to popular influence, a question likely to excite much and keen discussion, what is the requisite amount of restriction. And here there will be no difficulty as to overt acts against a government, such as rising in arms to alter it, &c. But as regards spoken and written opinions affecting the government, it must always be a nice problem to hit the precise point at which the safety of the government and the interests of free discussion are both sufficiently consulted. It will be the natural aim of those who possess the governing power, mingling their own personal feelings with public duties, to overstretch the proper limits of free discussion; and, on the other hand, the mass of the community, looking at the question from an opposite point of view, will be disposed to attach less importance than may be proper to the security of the government. In all governments in which it can be a question whether there shall be more or less restriction, there will probably be much discussion and dispute, and perhaps conflict, before the question is properly adjusted. In the case of a despotism there is of course no toleration of political opinion. But in constitutional governments, see the difference between the degree of toleration of political discussion established among ourselves, and in France or in the German states, even the freest of them—for instance, Baden and Würtemberg. And see the struggles which the people of England have undergone to achieve the degree of freedom as to political meetings and the press, which is now enjoyed in this country.

There remains to be considered the question of the toleration of religious opinions in a state, to which question the use of the word *toleration* is often specially appropriated. This question presents two aspects, according as there exists or does not exist an established religion or church-establishment in a political society. We are here concerned only with the existence or non-existence of an established religion as facts, and finding political societies either with or without one, have to adapt the question of religious toleration to the two cases. The question of the desirableness of an established religion has been already considered, so far as is compatible with the object of this work, in the article CHURCH.

Where no particular system of religion has been adopted by the governing power in a state, and distinguished from all others, no question arises save that of the duty of repressing, in whatever may be the most efficacious mode, the publication of opinions hostile to the foundation of religions. This exception to the general toleration of all opinions on religion, which is implied in the absence of an established religion, is thus expressed and argued by Dr. Paley, an enlightened advocate of religious toleration by a church establishment: 'Under the idea of religious toleration I include the toleration of all books of serious argumentation: but I deem it no infringement of religious liberty to restrain the circulation of ridicule, invective, and mockery upon religious subjects; because this species of writing applies solely to the passions, weakens the judgment, and contaminates the imagination of its readers; has no tendency whatever to assist either the investigation or the impression of truth: on the contrary, whilst it stays not to distinguish between the authority of different religions, it destroys alike the influence of all.' (*Moral and Political Philosophy*, p. 472, ed. 1830, 6 vols. 8vo.) The repression of profaneness and blasphemy rests upon the same grounds as that of indecency and immorality.

But where a church establishment exists, there has at once been made a distinction between one set of religious opinions and all others, and power and preeminence have been given to the holders of the favoured religion over those of all other religious denominations. They who are thus powerful and preeminent will, in human nature, be prone to use their advantages to the prejudice of those who dissent from their own religious views; and the history of all states accordingly presents a series of struggles between the dominant religion and other sects; the first striving to suppress by violent punishments, or by exclusion from civil privileges, all whose religious tenets are not those of the establishment, and the latter fighting for the rights of conscience and the cause of free discussion of truth. Here there is an inequality to begin with, which is submitted to. The holders of a particular religion are taken under the protection of the governing power in the state, and by it used for the general education of the nation, and for the performance of public ceremonies of religion; the state endows its ministers, and confers upon them social honours, such as it is in the power of a government to confer. But together with this inequality there may and there ought to be toleration of all other religions, so as to allow of the public profession of them, and to admit the holders of them to all offices and privileges, save those which are connected with the established church. This toleration is compatible with an efficient establishment for religion, and is required, for the sake of truth and of the rights of individual conscience, by a public policy grounded on the general happiness. Let then a church establishment exist as a means by which the governing power in a state may most effectually educate its people, and maintain and promote their civilization; and at the same time let all who dissent from the established religion pursue in peace the worship which they severally approve of, and let all members of the state, of whatever religious denomination, participate equally in civil rights, except so far as such participation may tend to destroy the church establishment.

There is no part of Dr. Paley's well-known treatise on 'Moral and Political Philosophy' of greater merit than the chapter 'Of Religious Establishments and of Toleration.' Having contended for the existence of a church establishment, and having in the course of his argument for this purpose laid down the two propositions, that any form of Christianity is better than no religion at all, and that, of different systems of faith, that is the best which is the truest, he proceeds:—'Toleration is of two kinds; the allowing to dissenters the unmolested profession and exercise of their religion, but with an exclusion from offices of trust and emolument in the state, which is a *partial* toleration; and the admitting them, without distinction, to all the civil privileges and capacities of other citizens, which is a *complete* toleration. The expediency of toleration, and consequently the right of any citizen to demand it, as far as relates to liberty of conscience, and the claim of being protected in the free and safe profession of his religion, is deducible from the second of those propositions which we have delivered as the grounds of our conclusions upon the subject. That proposition asserts truth, and truth in the abstract, to be the supreme perfection of every religion. The advancement, consequently, and discovery of truth, is that end to which all regulations concerning religion ought properly to be adapted. Now, every species of intolerance which enjoins suppression and silence, and every species of persecution which enforces such injunctions, is adverse to the progress of truth; forasmuch as it causes that to be fixed by one set of men at one time, which is much better, and with much more probability of success, left to the independent and progressive inquiry of separate individuals. Truth results from discussion and from controversy. . . . . In religion, as in other subjects, truth, if left to itself, will almost always obtain the ascendency. If different religions be professed in the same country, and the minds of men remain unfettered and unawed by intimidations of law, that religion which is founded on maxims of religion and credibility will gradually gain over the other to it. . . . . The justice and expediency of toleration are found primarily in its conduciveness to truth, and in the superior value of truth to that of any other quality which a religion can possess: this is the principal argument, but there are some auxiliary considerations too important to be omitted. The confining of the subject to the religion of the state is a needless violation of natural liberty, and is an instance in which constraint is always grievous. Persecution produces no sincere conviction, nor any real change of opinion: on the contrary, it vitiates the public morals, by driving men to prevarication; and commonly ends in a general though secret infidelity, by imposing, under the name of revealed religion, systems of doctrine which men cannot believe, and dare not examine; finally, it disguises the character and wounds the reputation of Christianity itself, by making it the author of oppression, cruelty, and bloodshed.

'Concerning the admission of dissenters from the established religion to offices and employments in the public service (which is necessary to render toleration *complete*), doubts have been entertained with some appearance of reason. It is possible that such religious opinions may be holden as are utterly incompatible with the necessary functions of civil government; and which opinions consequently disqualify those who maintain them from exercising any share in its administration. . . . . This is possible; therefore it cannot be laid down as a universal truth, that religion is not in its nature a cause which will justify exclusion from public employments. When we examine, however, the sects of Christianity which actually prevail in the world, we must confess that, with the single exception of refusing to bear arms, we find no tenet in any of them which incapacitates men for the service of the state. It has indeed been asserted that discordancy of religions, even supposing each religion to be free from any errors that affect the safety or the conduct of government, is enough to render men unfit to act together in public stations. But upon what argument, or upon what experience, is this assertion founded? I perceive no reason why men of different religious persuasions may not sit together upon the same bench, deliberate in the same council, or fight in the same ranks, as well as men of various or opposite opinions upon any controverted topic of natural philosophy, history, or ethics.' (pp. 470-3.)

Such is the clear, cogent, and temperate statement of the question of religious toleration by an eminent member of the Church of England. The question has been treated at greater length, from different points of view, and with differences of opinion in detail, but always with eminent advantage to the cause of toleration, whose progress in England has been materially aided by them, by Chillingworth in his 'Religion of Protestants a safe Way to Salvation,' by Jeremy Taylor in his 'Liberty of Prophesying,' and by Locke in his 'Treatises on Toleration.'

The history of the literature of toleration generally, and in our own country in particular, and the history of religious toleration itself in the several European states, and particularly in England, are subjects all of them interesting, but any one of which it would be impossible to treat within the limits of this article. The leading points of the history of religious toleration in our own country are indicated in the article Dissenters.

TOLETA'NUS, RODERI'CUS, or RODRI'GO DE TOLE'DO, an eminent ecclesiastic and historian, was born at Rada, in Navarre, about A.D. 1170. His name was Rodrigo Simonis, commonly Ximenez; but he is better known as Rodericus Toletanus. On his return from Paris, where his parents sent him to complete his education, he attached himself to Sancho V., king of Navarre, by whom he was employed to negotiate a peace with Alfonso VIII. of Castile. The manner in which he discharged this mission procured him the favour of Alfonso, by whom, in 1192, he was appointed bishop of Siguenza, and on the death of Don Martin, archbishop of Toledo, he was raised to the vacant see. He showed great zeal in the frequent wars with the Moors, and at the battle of Las Navas, where the Almohades, under Mohammed An-násir, were defeated by Alfonso, his pennon was the first that entered the dense ranks of the enemy. Indeed such were his courage and martial disposition, that even when the king was at peace with the Moors, he would, at the head of his own vassals, make frequent inroads into the Mohammedan territory. He enjoyed so much favour with the kings of his time, especially with San Fernando, that nothing was undertaken without consulting him. His zeal for learning was no less ardent than his hatred of the infidel. He persuaded Alfonso to found the university of Palencia, and thereby avoid the necessity of sending youths to be educated in foreign countries. At the fourth Lateran council he is said not only to have harangued the fathers in elegant Latin, but to have gained over the secular nobles and ambassadors by conversing with each of them in his mother tongue. He died in France, in 1247, after attending the council of Lyon, convoked by Innocent IV. His body was carried to Castile, and interred in the Cistercian monastery of Huerta. To him the history of his native country is more indebted than to any other man. He wrote several historical works, most of which are still inedited. His 'Rerum in Hispania Gestarum Chronicon,' which contains a history of the Peninsula from the most remote period to his own time, is an invaluable production. It was printed for the first time at Granada, in 1545, together with the chronicle of Antonius Nebrissensis, and was subsequently published in the collection entitled 'Hispania Illustrata,' by Andreas Schott, Frankfort, 1603-8, 4 vols. fol. His 'Historia Arabum,' or history of the western Arabs from the birth of the Mohammedan prophet to the invasion of Spain by the Almoravides, shows him to have been well versed in the language and history of the Arabs. This valuable work was first published, in 1603, in the second volume of Andreas Schott, 'Hispania Illustrata,' and subsequently, in 1625, by Erpennius, as an appendix to his 'Historia Sarracenica' of Georgius Elmacin. There is a third edition. He also wrote a history of the Ostro-Goths, another of the Huns, Vandals, Suevi, Alans, and Silingi, which were first published by Robert Bell in the collection entitled 'Rerum Hispanicarum Scriptores aliquot,' Frankfort, 1579, 3 vols. fol., and subsequently by Schott; a history of the Old and New Testament, entitled 'Breviarium Ecclesiæ Catholicæ,' still inedited, and other works, the list of which may be seen in Nicolas Antonio.

(Mariana, *Hist. Gen. de España*, lib. ii., cap. 22; Zurita, *Annales de Aragon*, lib. ii., cap. 67; Nicolas Antonio, *Bibl. Hist. Vetus*, ii. 50.)

TOLL, from the Saxon 'tolne;' in German, 'zoll' (called in Law Latin 'telonium,' 'theolonium,' and 'tolnetum,' with many other variations, which may be seen in Ducange, all which Latin terms are derived apparently from τελώνιον, 'collection of tribute or revenue'), is a payment in money or in kind, fixed in amount, made either under a royal grant, or under a prescriptive usage from which the existence, at some former period, of such a grant is implied, in consideration of some service rendered, benefit conferred, or right forborne to be exercised, by the party entitled to such payment.

The owner of land may in general prevent others from crossing it either personally or with their cattle or goods, by bringing actions against trespassers, or distraining their cattle or goods. [Distress.] These remedies cannot be resorted to where the owner of the land has acquiesced in its being used as a public way; but in such case there may have been a royal grant, enabling the party to demand a reasonable compensation for the accommodation: this is toll-*traverse*.

Where a corporation, or the owner of particular lands, has immemorially repaired the streets or walls of a town, or a bridge, &c., and, in consideration of the obligation to repair, has immemorially received certain reasonable sums in respect of persons, cattle, or goods passing through the town, such sums are recoverable at law by the name of toll-*thorough*.

An antient toll may be claimed by the owner of a port in respect of goods shipped or landed there. Such tolls are port-tolls, more commonly called port-dues. The place at which these tolls were set or assessed was antiently called the Tolsey, where, as at the modern Exchange, the merchants usually assembled, and where commercial courts were held.

Another species of toll is a reasonable fixed sum payable by royal grant or prescription to the owner of a Fair or Market, from the buyer of tollable articles sold there. The benefit which forms the consideration of this toll is said to be the security afforded by the attestation of the sale by the owner of the fair or market, or his officers. It is not due unless the article be brought in bulk into the fair or market. Where however the proper and usual course has been to bring the bulk into the fair or market, the owner of the fair or market may maintain an action against a party who sells by sample, in order to deprive him of his toll. In some cases, by antient custom, a payment, called turn-toll, is demandable for beasts which are driven to the market and return unsold. The term toll is sometimes extended to the compensation paid for the use of the soil by those who erect stalls in the fair or market, or for the liberty of picking holes for the purpose of temporary erections; but the former payment is more properly called stallage, and the latter picage; and if the franchise of the fair or market, and the ownership of the soil on which it is held, come into different hands, the stallage and picage go to the owner of the soil, while the tolls, properly so called, are annexed to the franchise.

If tolls are wrongfully withheld, the party entitled may recover the amount by action as for a debt, or upon an implied promise of payment, or he may seize and detain the whole or any part of the property in respect of which the toll is payable, by way of distress for such toll. If excessive toll be taken by the lord, or with his knowledge and consent, the franchise shall be seised; if without such consent, the officers shall pay double damages and suffer imprisonment. (Stat. 3 Edw. I., c. 31.)

Grants of tolls were formerly of very ordinary occurrence. But it seems to be very probable that many antient payments of this description, though presumed, from their being so long acquiesced in, to have a lawful origin under a royal grant, were in fact mere encroachments. The evil was however practically lessened by the exertion of the royal prerogative of granting immunities and exemptions from liability to the payment of tolls, either in particular districts or throughout the realm; a prerogative exercised also by inferior lords who possessed jura regalia. Thus Reginald de Dunstanville, earl of Cornwall, granted to his burgesses of Truveru (Truro) to be free of toll throughout Cornwall. (*Plac. de Quo Warranto, temp.* Edw. I., II., III., 111.) If a party entitled to exemption was wrongfully compelled to pay toll, the remedy was by writ de essendo quietum de theolonio (of being quit of toll), which might be brought, either by the individual aggrieved, or by the exempted body of which he was a member. (*Reg. Brev.*, 258; F. N. B., 226, b.)

The term 'toll' is used in modern acts of parliament to designate the payment directed to be made to the proprietors of canals and railways, the trustees of turnpike-roads or bridges, &c., in respect of the passage of passengers or the conveyance of cattle or goods.

The term toll is applied to the portion which an artificer is, by custom or agreement, allowed to retain out of the bulk in respect of services performed by him upon the article; as corn retained by a miller in payment of the mulcture; also to the portion of mineral which the owner of the soil is entitled, by custom or by agreement, to take, without payment, out of the quantity brought to the surface, or, as it is technically called, *to grass*, and made merchantable, by the mining adventurer. To collect these dues the duke of Cornwall, and other great landholders in the mining districts of the west, have their officers, called 'tollers.'

TOLLERS. [Toll.]

TO'LLIUS, CORNE'LIUS, a Dutch philologer, was born at Utrecht about the year 1620. His father, who had two other sons, Jacob and Alexander, possessed no means of giving his children a good education, but he had in G. J. Vossius a friend who gratuitously supplied the want. After Cornelius had for some years enjoyed the private instructions of Vossius, he entered the academy of Amsterdam, and continued his philological studies under the auspices of his benefactor, who had formed a strong attachment to him, and made him his private secretary (famulus). In 1648 Tollius obtained the professorship of eloquence and of the Greek language at the academy of Harderwyk. The year after this event Vossius died, and Tollius delivered on the occasion the customary eulogy, which was printed under the title 'Oratio in obitum G. J. Vossii,' Amsterdam, 1649, 4to. During his stay at Harderwyk Tollius exercised great influence on the affairs of the Academy, for the curators are said to have had such confidence in him that they never appointed a professor without his previous sanction. The year of his death is not certain, but it appears to have been soon after 1652; this year at least is the last in which any work of his appeared.

The works of Tollius are not numerous, but he had formed the plans for an edition of Valerius Maximus and Phurnutus, which his early death prevented him from executing. There is an edition of the work of J. P. Valerianus, 'De Infelicitate Literatorum,' Amsterdam, 1647, 12mo., with supplements by Tollius, which give some interesting accounts of literary men, and was in its time very popular. The Supplements were translated into French by Coupé, and inserted in his 'Soirées Littéraires,' vol. xvi., p. 56, &c. He also edited Palaephatus, 'De Incredibilibus,' Amsterdam, 1649, 12mo., with notes and a Latin translation; Joannes Cinnamus, 'De Rebus Joannis et Manuelis Comnenorum Libri iv.,' with emendations and a Latin translation, Amsterdam, 1652, 4to.

Tollius has been charged by his biographers with having appropriated numerous remarks and emendations on antient authors which he found among the papers of his benefactor Vossius, but how far this is true cannot now be ascertained. (Casp. Burmann, *Trajectum Eruditum*, p. 367, &c.; Saxius, *Onomasticum Literarium*, vol. iv., p. 528.)

TOLLIUS, JACOB, a brother of Cornelius, was born about 1630, at Utrecht. He received his first education at Deventer, and afterwards studied under G. J. Vossius, who showed him the same kindness which he had before shown to his brother Cornelius. The younger Tollius is charged, and apparently with justice, with having been very ungrateful towards his benefactor, inasmuch as he appropriated to himself much which Vossius had written in illustration of the antient writers. After the death of Vossius, Tollius returned to Utrecht, and became a corrector of the press in the printing establishment of J. Blaeuw, at Amsterdam. He gave perfect satisfaction to his employer, both by his great knowledge and the conscientious discharge of his duties. In the meantime D. Heinsius, who was staying at Stockholm, and preparing for a journey to Italy under a commission from Queen Christina, offered to Tollius the place of secretary to the commission. Tollius accepted the offer, and set out for Stockholm in 1662.

Being entrusted with the various papers and manuscripts of Heinsius, his old piratical inclination revived; when Heinsius discovered this, and, it would seem, some additional and more serious offences, Tollius was dismissed, and returned to Holland, where after a short time the influence of his friends procured him the office of rector of the gymnasium at Gouda. Here he devoted all his leisure hours to the study of medicine, and in 1669 he obtained the degree of Doctor of Physic. Some dispute between him and the curators of the gymnasium, and his free and unreserved mode of dealing with them, became the cause of his being deprived of his office at Gouda in 1673. After this he for some time practised medicine, and gave private lessons in Latin and Greek at Nordwyk. Finding that he could not gain a subsistence, he again obtained an appointment as teacher at Leyden, but in 1679 he gave up his place for that of professor of history and eloquence in the university of Duisburg. His reputation as a mineralogist was also great; and in the year 1687 the elector of Brandenburg commissioned him to travel through Germany and Italy for the purpose of examining the mines of those countries. It appears that he faithfully discharged this commission. In Italy he was most hospitably received by Cardinal Barberini; and Tollius, who had hitherto not been promoted in his own country as he thought he deserved, secretly embraced the Roman Catholic religion. His long stay in Italy created in Germany some suspicion of his having renounced Protestantism; and on hearing this he hastened, in 1690, from Rome to Berlin. His reception by the elector however was of such a nature that he thought it advisable to leave Berlin and return to Holland. Tollius, being now again without means and employment, opened a school at Utrecht, but it was closed by order of the city authorities. His friends were displeased with his conduct, and forsook him one after another; he sank into deep poverty, and died June 22, 1696.

The works of Tollius are rather numerous, and are partly philological, partly alchymistical, and partly on his travels. Among his alchymistical works are his 'Fortuita, in quibus praeter critica nonnulla, tota fabularis historia, Graeca, Phoenicia, Aegyptiaca, ad chemiam pertinere asseritur,' Amsterdam, 1688, 8vo. He published an edition of Ausonius, Amsterdam, 1671, which is the Variorum edition of Ausonius, and is still very useful; and also an edition of Longinus, Utrecht, 1694, 4to., with notes and a Latin translation. Tollius translated into Latin the Italian work of Bacchini, 'De Sistris,' Utrecht, 1696, and the account of antient Rome, by Nardini, both of which are incorporated in Graevius, 'Thesaurus Antiquitatum Romanarum,' vols. iv. and vi. He is also the author of 'Gustus Animadversionum Criticarum ad Longinum cum Observatis in Ciceronis Orationem pro Archia,' Leyden, 1667, 8vo. The works relating to his travels are:—'Insignia Itinerarii Italici, quibus continentur Antiquitates Sacrae,' Utrecht, 1696, 4to., and 'Epistolae Itinerariae, observationibus et figuris adornatae.' This work was edited, after the author's death, by H. C. Hennin, Amsterdam, 1700, 4to., and is of greater use and interest than the former. There are also some dissertations on antient poets, by Tollius, in Berkelius, 'Dissertationes selectae criticae de Poetis,' Leyden, 1704, 8vo.

(Casp. Burmann, *Trajectum Eruditum*, p. 368, &c.; Saxius, *Onomasticum Literarium*, vol. v., p. 189, &c.)

TOLMEZZO. [UDINE.]

TOLNA, a county in Hungary, in the circle beyond the Danube, is bounded on the north by Vespium and Stuhlweissenburg, on the east by Pesth, on the south by Baranya, and on the west by Szumg. Its area is 1365 square miles, and the number of inhabitants 173,682, chiefly Hungarians and Germans. The eastern part of the county, between the Danube and the Sarwitz, is for the most part a plain; beyond the Sarwitz there are mountains and hills with broad and fertile valleys. The principal rivers are, the Danube, which separates this county from that of Pesth, the Sarwitz, and the Kapos. In the abovementioned plain, which is one of the largest in Hungary, there is a good deal of sandy soil. On the whole however the country has a very fertile soil, as the abundance and excellence of its productions evince. The climate too is healthy, except on the marshes on the banks of the Sarwitz. The county produces wheat of very fine quality, maize, millet, potatoes, rapeseed, and poppy; from the two last great quantities of oil are made. The cultivation of the vine is very considerable. The dark red wine of Szekszard (or Sexard) in particular, especially the Ausbruch, is celebrated for its strength and aromatic flavour. There is much fruit of various kinds: vast quantities of tobacco are grown; also flax and madder. Oxen and swine are very numerous, and of late years great attention has been paid to the breed of sheep, which has been improved by the introduction of merinos. The fisheries in the rivers are very productive, especially that of the sturgeon in the Danube. The productive land in the county is stated as 526,703 acres; of which 244,008 acres are allotted to agriculture, 44,455 to the vineyards, 7812 to horticulture, and 165,130 acres are covered with forests. The great extent of these forests seems to have led the owners to fancy that they were inexhaustible, so that, as the author of the 'Statistical and Geographical Description of Hungary, Croatia, and Slavonia' says, 'Count Festetits has not hesitated to fell large tracts for the purpose of making potash, and this in sight of that county in which the inhabitants are in want of wood for fuel, and obliged to use the dung of the cattle.' There are no minerals worth noticing in this county. No manufactories are to be found here, nor are there any superior schools.

The principal towns are—Szekszard, the chief town, situated near the river Sarwitz, over which there is a long and very handsome bridge; it is tolerably well built, and has above 8000 inhabitants. The principal buildings are the Roman Catholic church and the county-hall, situated on a hill. 2, Földvar, on the Danube, pleasantly situated partly on a hill, partly on the declivity of it; the population is above 9000, who are engaged in agriculture, the cultivation of the vine, and the sturgeon fishery. It is the chief town of the district of Tolna, and has a Roman Catholic school. 3, Tolna, on the Danube, with about 2000 inhabitants (though Blumenbach says 4700), was formerly a more considerable place than it now is. A diet was held here in the year 1518. The inhabitants live by the fishery and the manufacture of potash: there are numerous mills on the Danube: a great deal of strong glue is made here. 4, Paks, a large and handsome market-town on the Danube, with 7300 inhabitants; much wine is made here, and the fishery employs many of the inhabitants. Many nobles and Jews live in this town. 5, Ozora, a market-town, with 3200 inhabitants, belonging to Prince Esterhazy: a large castle is used partly as a magazine, partly as a prison: here is a considerable stud and extensive sheep-walks.

(Blumenbach, *Gemälde der Oesterreichischen Monarchie; Neueste Beschreibung von Ungern;* Hassel; Stein; Cannabich.)

TOLOMEI, CLAUDIO, born at Siena, of a noble family, in 1492, studied the law in his native town, and afterwards went to Rome, where he founded an academy called 'Della Virtù,' of which Caro, Molza, Flaminio, and other learned men of Rome became members, and one of the purposes of which was the illustration of Vitruvius and the encouragement of architecture. Tolomei afterwards conceived the idea of introducing into the Italian poetry the Latin metre of the hexameters and pentameters, and he published rules and specimens for the purpose: 'Versi e Regole della nuova Poesia Toscana,' Rome, 1539. But this innovation, which had been already attempted by Leone Battista Alberti, did not succeed, and the Italian hexameters and pentameters soon fell into oblivion. Here is a specimen of one of the distichs:—

'Ecco 'l | chiaro ri | o, pien | eccolo | d'acque so | avi;
Ecco di | verdi er | be | carca la | terra ri | de.'

Tolomei was for a time in the service of the cardinal Ippolito d'Este, who sent him on a mission to Vienna in 1532. He afterwards attached himself to the court of Pier Luigi Farnese, son of Pope Paul III., and duke of Castro, and followed him to Piacenza, when Pier Luigi was created duke of Parma and Piacenza. After the tragical death of Pier Luigi, in 1547, Tolomei returned to Rome, where he lived in straitened circumstances, until his countrymen of Siena chose him, in 1552, for their ambassador to Henri II. of France, who protected the independence of that republic, threatened by the Medici and by Charles V. Tolomei repaired to Compiègne, where he delivered an oration to the king in presence of his court, which was afterwards published: 'Orazione recitata dinanzi al Rè di Francia Enrico II. à Compiègne,' Paris, 1553. He died soon after his return to Rome, in 1554. He wrote several other orations in Italian, one of which, entitled 'Orazione della Pace,' Rome, 1534, has been most praised; a dialogue upon the Italian language; and several volumes of letters, which are the most interesting part of his writings—'Lettere di Claudio Tolomei, libri vii.,' 4to., Venice, 1547, afterwards repeatedly reprinted. He is one of the best letter-writers in the Italian language; his letters embrace a variety of subjects, scientific and philosophical, and his style is comprehensive and full of meaning. His correspondence was choice, and yet extensive. The edition of 1547 contains an important letter to his friend Gabriele Cesano, about the manner of making the government of a state durable and permanent, which letter has been left out in the subsequent editions. In another letter, addressed to Count Lando, he suggests the plan of several philological and archæological works for the illustration of Vitruvius.

(Corniani, *Secoli della Letteratura Italiana;* Tiraboschi, *Storia della Letteratura Italiana.*)

TOLO'SA, a district of the province of Guipuzcoa, in Spain. Tolosa, supposed to be the antient Iturisa, is not only the capital of the district, but that of the whole province. It is situated in the middle of a deep valley formed by the two mountains of Ernio and Loazu, and on the banks of two small rivers called Oria and Arages, which join their waters close to the town: 43° 8′ N. lat., 2° 12′ W. long. The town is well built, and clean, like most towns in Biscay; the streets are tolerably wide and straight. There are three squares, the principal of which (Plaza Mayor), which serves also as an arena for bull-fights, is very fine. Tolosa has few antient buildings, and none that is worthy the attention of the artist. During the late civil war the Pretender Don Carlos often resided in Tolosa. The population, according to Miñano (vol. viii., p. 462), amounted only to 6000 souls in 1827.

TOLSEY. [TOLL.]

TOLU, BALSAM OF. [MYROSPERMUM.]

TOLUCA. [MEXICAN STATES, vol. xv., p. 160.]

TOMAHAWK, an Indian hatchet. Dr. Webster, of New York, who gives the above definition in his 'Dictionary of the English Language,' gives the word also as a verb, meaning 'to cut or kill with a hatchet called a tomahawk.' Catlin, in his recent work on the Manners, Customs, and Condition of the North American Indians (vol. i., p. 236, plate 99), states that the tomahawks of Indian manufacture are, like other native weapons, headed with stone, but that the ordinary metal blades or heads are 'of civilized manufacture, made expressly for Indian use, carried into the Indian country by thousands and tens of thousands, and sold at an enormous price.' The handles are usually made by the Indians themselves, and are often highly ornamented. Some tomahawks are formed with a bowl for burning tobacco in the head, and a hole through the handle to serve for a pipe. 'These,' Catlin observes, 'are the most valued of an Indian's weapons, inasmuch as they are a matter of luxury, and useful for cutting his firewood, &c., in time of peace, and deadly weapons in time of war, which they use in the hand, or throw with unerring and deadly aim.'

TOMATO. [SOLANUM.]

TOMB (in Greek, τύμβος; Latin, *Tumba;* Italian, *Tomba:* French, *Tombe* and *Tombeau*) signifies, in its strict meaning, a mass of masonry or stone-work raised immediately over a grave or vault used for interment; but it is often applied, in a wider sense, to any sepulchral structure. Works of either of these two classes constitute an important branch of archæological study, inasmuch as they supply so many and such various materials for it, not only as regards the arts of painting and sculpture, but the objects described by them, and a number of utensils and manufactured articles discovered in such repositories. It is sufficient to mention the tombs of Egypt and of Etruria, in both of which interesting discoveries have been made of late years. The Christian catacombs [CATACOMBS] have likewise furnished much towards the history of art; and the tombs and sepulchral monuments of the middle ages, down almost to our own times, are valuable monuments, either as specimens of architecture and sculpture, singly or combined; or as handing down to us inscriptions and dates, and portraits and effigies of historical personages.

Of primitive sepulchres there are two classes—both of such high antiquity, that it is doubtful which is entitled to precedence—one of which may be distinguished by the general term *Hypogæan*, that is, subterraneous and excavated; the other, by that of *Hypergæan*, that is, *above-ground*, or raised mounds or tumuli heaped over the dead. Monuments of the first kind are very numerous in Egypt, where they occur in every variety, from the simple rock-hewn tomb to the extensive royal sepulchres consisting of numerous galleries and chambers. The other class presents itself in the Pyramids, which, though far more artificial in form and construction, had no doubt a common origin with the Tumulus [TUMULUS], which occurs under various designations in every part of the globe.

The extraordinary labour bestowed in excavating or constructing these antient sepulchres is perhaps not so surprising as the lavishness with which the antients embellished the subterraneous abodes of the dead, not only adorning them with polychromy and paintings, but depositing in them the most costly and exquisitely-wrought articles. In this respect there was a striking similarity between the practice of the Egyptians and that of the Etrurians, nor is the coincidence the less remarkable from such practice being contrary to that of the comparatively modern Greeks and Romans, whose tombs and sepulchres were chiefly architectural erections intended for external display. Of Egyptian architecture and art some of the most astonishing memorials are entombed within the earth. Among these are what are called the 'Tombs of the Egyptian Kings,' at Bibân el Molouk, in one of which Belzoni discovered the sarcophagus, or tomb, properly so termed, which is now in the Soanean Museum. In respect to the architecture of these subterraneous works, the arrangement of their plans is precisely the reverse of that of the temples, in which the parts are successively contracted in space, that last reached being the smallest of all [EGYPTIAN ARCHITECTURE, p. 316]; whereas in these tombs the entrance passages are narrow, and the first chambers are smaller than those to which they lead. The numerous paintings found in these tombs describe with minuteness the social life and manners of the people, their banquets, their festivals, their amusements, their costume, their furniture, their arts, and the various utensils and implements employed in them. These records prove not only the perfection the mechanic arts had attained, but also the luxurious refinement of those remote ages. The same remark applies to the paintings and frescoes in the subterraneous tombs and sepulchral chambers discovered since 1827 at Corneto, on the site of the antient Tarquinii, at Vulci, Toscanella, Bomarzo, Cere, Val d'Asso, and other places in the antient Etruria. The number of these tombs is very great. About two thousand have been opened, and from these have been obtained, besides upwards of five thousand painted terracottas and vases, an immense quantity of other articles of almost every description,—military weapons, tripods and sacrificial utensils, candelabra of all patterns and dimensions, sarcophagi, couches, sculptures, inscriptions, &c., together with bracelets, rings, ear-rings, and other ornaments of dress, some of them of the most tasteful design and exquisite workmanship.* The greater portion of these antiquities are deposited in the new Museo Gregoriano at Rome; but no inconsiderable number of them have found their way into other collections, especially those of Berlin and Münich. If not the most valuable part of the spoils obtained from the Etrurian tombs, the paintings on their walls were not the least interesting, especially when first discovered; for since that time they have all suffered by exposure to the air. While they are for the most part more carefully and better executed than the Egyptian paintings, they are equally curious, inasmuch as they are almost the only existing records of a people respecting whom history has preserved very little. One of the most interesting sepulchral chambers yet opened is that which has been named, from the subjects represented on its walls, the 'Camera del Triclinio e del Ballo.' In the 'Triclinio,' or banquet scene, are three couches, with a male and female figure upon each, crowned with wreaths of ivy and myrtle, and richly attired. Everything bespeaks luxurious refinement,—the embroidered table-cloth, and draperies on the couches, the rich dresses of the attendants, the quantity and variety of the vessels heaped up on the sideboard, and the number of dishes with which the table is set out. Nor does the other scene convey a less favourable idea of the gaiety and liveliness of an Etruscan dance. The subjects of some of the paintings that have been discovered are however of a very different character; and as a contrast to the above may be mentioned those in what is distinguished by the name of the 'Camera de' Morti,' at Tarquinii; one of which represents a procession of the dead, conducted by genii to their final judgment. These and other paintings are described in Mrs. Hamilton Gray's 'Tour to the Sepulchres of Etruria;' and a very interesting account of the tombs and their contents has been given by Carlo Avvolta, in the 'Annali dell' Instituto di Corrispondenza Archeologica, per l'anno 1829.' Of Etruscan art generally, Winckelmann speaks in the third book of his 'Geschichte der Kunst,' but in his time only a few of the tombs had been opened.

At other places in Etruria—Orchia, the modern Norchia, and Axia, now called Castel d'Asso—the tombs are hewn out on the sides of rocks and hills, and present an architectural frontispiece or façade forming their entrance, as is the case with many Egyptian tombs, and likewise with those which are found in Lycia and other parts of Asia Minor. Many of the Lycian tombs have columns and entablatures to their façades wrought out of the solid rock. Some of the Lycian tombs however are upright insulated structures, either plain or decorated with pilasters and other ornaments, with roofs whose section is a pointed arch, after the fashion of some of the Indian monuments, owing to which they present a striking combination of Oriental and Grecian forms. Of sepulchres with temple-shaped façades there are two examples at Orchia, one of them a tetrastyle, the other a distyle in antis. Both partake of the Grecian Doric character, yet deviate from it greatly in two particulars: first, in the great height of the pediment; secondly, in the great width of the intercolumns. What now remains of the columns themselves is only sufficient to show their number and situation; yet that they were hewn out of the rock, like the entablature and pediment, scarcely admits of question.

Vitruvius says nothing on the subject of sepulchres and tombs, either Grecian or Roman; yet sepulchral edifices are still very numerous throughout Latium and Magna Græcia, and many of them must originally have been very conspicuous objects, and not a little remarkable on account of the studied architectural decoration bestowed on them externally; for besides subterraneous sepulchral chambers or vaults (which were usually very carefully finished internally, and not unfrequently ornamented with painting and stucco-work, and with marble or mosaic pavements), there is another and quite distinct class, consisting of structures raised above-ground, insulated, and apparently solid. These may be described as generally of nearly cubical form, though some are of much loftier proportions. There are besides varieties of this class, in which either a conical or cylindrical superstructure is raised upon the square portion, which then becomes a basement; or else the superstructure is also square, but is distinguished from the lower part by pilasters, pannels with inscriptions, and other architectural decorations: some of these have an upper sepulchral chamber, others a subterraneous one also, or one below the level of the ground.

What is called the 'Sepolcro di Nerone,' near Ponte Molle, may be taken as a specimen of the usual character of Roman tombs partaking of the cubic form. Like the generality of them, this is somewhat more than a perfect cube, the dimensions being 20 feet by 24 in height, or, including its covering, 27 feet. At each angle is a large acroterium presenting two quadrant-shaped surfaces, meeting at right angles at the external edge of two adjoining sides; a species of ornament almost peculiar to antient altars and tombs. Of larger tombs of this class there is one in the Via Portuensis, a double cube in height, the measurements being respectively 44 and 80 feet. In the example previously mentioned, the upper part is rather less in height than the basement, but here it is about a third more, and is also decorated with four pilasters on each front, with a small pediment, not supporting, but placed *between* the large acroteria at the angles. Of circular tombs we have a well-known example in that of Manutius Plancus at Gaeta; a low circular tower (nearly solid within), about 60 feet in diameter, and 10 feet more in height; therefore, owing to its size, it is rather a mausoleum than a mere tomb. The same may be said of that of Cæcilia Metella at Rome; which structure, otherwise called Il Capo di Bove, from the ornaments in its Doric frieze, exceeds the one just mentioned in size, it being 90 feet in diameter, and its entire height about 130 feet. It does not however partake so much of the character of a mere tower as the tomb at Gaeta, because it consists of two nearly equal masses, viz. a square one with a cylindrical superstructure, and is therefore an example of that compound-form class which we have above pointed out. Among the tombs at Pompeii there is one which is circular in the upper part of its exterior, and internally has a dome of very peculiar shape, which does not show itself on the outside, but is cut out of the solid mass. Other sepulchral structures at Pompeii are very numerous, forming what is called the 'Street of Tombs.' Instead of cemeteries, or public burying-grounds, it was the custom in antient Italy to erect tombs on each side of the principal roads leading from a city, as was the case with the Via Appia and others in the immediate vicinity of Rome.

The tombs of the middle ages are within buildings, churches, chantries, cloisters, &c., and exhibit almost every variety of form and enrichment, from the primitive stone coffin or Christian sarcophagus, to those lavishly decorated *catafalco* monuments which are so many piles of architecture and sculpture. Those of the first-mentioned kind are, for the most part, very little raised above the floor, and their upper surface is *en dos d'âne*, or forms a ridge-shaped lid. The next class consists of *Altar* or *Table Tombs*, comparatively plain, although with panelling or other architectural decoration on their sides. The next in order is the *Effigy Tomb*, first introduced in the thirteenth century, with a recumbent figure of the deceased upon it, extended, with the hands slightly raised, and joined as if in the attitude of prayer. Examples of this kind are very numerous, and highly interesting, both on account of their execution as works of sculpture, and the information they afford in regard to the costume of the period. In some cases there is a small canopy over the head of the figure, placed, similarly to that effigy, in a horizontal direction. This will be best understood from the annexed representation of the monument of Eleanor Bohun, wife of Thomas of Woodstock, duke of Gloucester.

This is not indeed exactly a specimen of the class just referred to, it being a monumental inlaid brass (a species of monument very common in this country during the fourteenth and fifteenth centuries); but although not executed in relief, it will serve to explain the usual character of sculptured recumbent effigies, and the design of the ornamental parts.

Altar and effigy tombs were usually placed between the piers of an arch, or within a recess in a wall, and in either case the whole tomb was frequently covered by an arch forming a sort of canopy over it; of which kind is that of Aymer de Valence in Westminster Abbey (1334). In course of time this mode of architectural decoration came

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* The Princess of Canino is said to have appeared some few years ago at a ball attired with costly ornaments that had been found in some of the ancient tombs of Etruria.

to be greatly extended. Instead of a single arch, three or more small arches were introduced, which, with the columns either supporting or placed between them, enclosed the figure on the tomb, giving the whole the appearance of a *shrine* or *screen*. Many of the French monuments of the period of the Renaissance are in this style of design, large and lofty insulated architectural masses, with a profusion of highly enriched pilasters and arches, and numerous allegorical figures, beside other statues and bas-reliefs, so that the *deposito*, or actual tomb, is the least portion of the entire composition.

In Italy there are many examples of what may be called *Façade* monuments, which are extensive architectural compositions, consisting of two or more orders of columns, with pediments, niches, statues, panels, and various other architectural decorations. Of such '*macchine colossali*,' as Cicognara terms them, the monument of the doge Valier by Tirali and that of the doge Pesaro by Longhena may be quoted as instances. In both of them the figures are merely accompaniments to the architecture, and that which should be the principal one is almost the most insignificant among them. In the Catafalc tomb, even when equally extravagant in point of accumulated embellishment, there is at least a certain degree of character that stamps it at first sight for what it is, whereas in those of the kind just referred to there is nothing to indicate a sepulchral monument. This last remark applies very forcibly to those two celebrated works of Michael Angelo, the tombs of Giuliano and Lorenzo de' Medici, each of which has, besides the figures of those personages, two naked semi-recumbent figures, a male and female, intended or supposed to be intended to express day and night (or sleep), and morning and evening. To say nothing of the obscurity and unmeaningness of such allegory, the statues themselves are very ill calculated to awaken religious sentiment. They are masterly academical productions, the triumph of the artist, the admiration of connoisseurs; but nothing more. Infinitely superior both in feeling and in taste are many other Italian tombs of about the same period, which consist of little more than a simple *deposito*, or sarcophagus, with either a recumbent or semi-recumbent figure of the deceased upon it; such for instance as those of Giov. Andr. Boccaccio in the cloister of Santa Maria della Pace, and of Angelo Marzi in the church of the Annunziata at Florence. Although they have abandoned the architectural *caricature* formerly in vogue for such purposes, instead of returning to the simple and natural expression of Christian monumental works, later sculptors have frequently given us allegorical compositions and groups of mythological figures, and the likeness of persons intended to be recorded is shown only in a medallion. In this vicious taste are many of the monuments in St. Paul's and Westminster Abbey, while others are chiefly remarkable for the fantastic conceits into which the artists have fallen, and which render them equally unbefitting the purpose they are designed for and the place where they are erected.

TOMBS, VAULTS, TOMBSTONES, TABLETS. In previous articles [COFFIN; INTERMENT] the various modes of disposing of the dead have been discussed; it is our intention here to show what rights the subjects of this country have, 1st, to burial, and 2ndly, to a permanent commemoration of themselves by means of monuments. It must be borne in mind that we treat here only of parish churches and churchyards, or of the parish burying-grounds subsidiary to the churchyard. The cemeteries which the necessities of an increasing population have caused to be established in the neighbourhood of many of our most densely inhabited towns are private property, regulated at the pleasure of the proprietors.

By the 68th Canon of 1603 it is ordered that no minister shall refuse or delay, under pain of suspension by the bishop for three months, to bury any corpse that is brought to the church or churchyard (convenient warning being given him thereof before), in such form as is prescribed by the Book of Common Prayer, unless the deceased were excommunicated *majori excommunicatione*, and no man able to testify of his repentance. The Rubrick further excludes from Christian burial those who have not been baptized or who have died by their own hands; and this latter class are defined to be such as have voluntarily killed themselves, being of sound mind, of which fact a coroner's jury are considered by ecclesiastical authorities to be the fitting judges. Thus the ecclesiastical law not only gives to the clergyman the right, but imposes on him the duty to bury, with only three exceptions, all who shall be brought within the precincts of his church. Nevertheless the ecclesiastical courts have admonished a minister and churchwardens to abstain from burying strangers in the churchyard, when the practice of doing so threatened to interfere with the rights of the parishioners; for the common law gives to the people the right of being buried within the churchyard of their own parishes: 'Ubi decimas persolvebat vivus, sepeliatur mortuus;' and although the freehold of the churchyard, as of the church, is in the parson, he holds it only for the benefit of his parishioners, and subject to their right of interment in it.

This right of sepulture however applies only to the body: the Canon and the Rubrick alike talk as though studiously of the 'corpse' alone, never mentioning the coffin. In former times the use of coffins was confined to the richer classes, and these were often of stone or of other durable materials [COFFIN]; but the practice and no doubt the intention was that in the great majority of cases the process of decay, and therefore the occupation of the earth, should not be needlessly protracted. To use the words of Lord Stowell, 'A common cemetery [by which he means a churchyard or parish burying-ground] is not *res unius ætatis*, the property of one generation now departed, but is likewise the common property of the living and of generations yet unborn, and is subject only to temporary occupations.' On this doctrine are based the main points of the law concerning burials.

The establishment of churchyards is attributed to Cuthbert, archbishop of Canterbury, who in the year 750 introduced into this country the custom, then existing at Rome, of devoting an enclosed space round the sacred edifice to the interment of those who had been entitled to attend or had been in the habit of attending worship within its walls. Theretofore, notwithstanding a canon which forbade it (*De non sepeliendo in Ecclesiis*), the clergy interred persons of peculiar sanctity or importance within the walls of the church, especially in the side aisles of the nave, so as to remind the faithful of their example and of the duty of praying for their souls: and hence the rule that a body cannot now be buried in the church without the consent of the incumbent, as he is supposed to be alone able to judge whether the deceased possessed the qualities which give him a title to that distinction. The churchyard was antiently held among the *res sacræ*, and no fees were taken for the use of it: nevertheless the payment of fees to the clergyman dates, in this country at least, from the Reformation, and the non-payment of those fees is held by the ecclesiastical courts a sufficient ground for the clergyman to withhold his offices, or at all events to prevent the erection of any monument or tablet for which he had previously given his consent; that consent being supposed to imply the payment of the usual or a stipulated fee. The fee is regarded by ecclesiastical writers not as a price paid for the burial, but as an offering to the minister; and the claim to it is founded on custom. The churchwardens are also entitled to a fee for burials in the church, since on them falls the expense of repairing the pavement. It is even maintained that an incumbent is entitled to a fee upon the burial of his parishioner who has died in his parish and is removed for interment elsewhere. Sir H. Spelman preserves a vestry constitution of 1627 containing a table of fees for burial in the chancel, the nave, and the churchyard; the interments in the churchyard being differently charged as they were 'coffined' or 'uncoffined.' These fees are not imposed at the discretion of the parson or of the parish; they are matter of ecclesiastical jurisdiction, and if they deviate from the amounts established by custom, must be approved by the ordinary after consulting the minister and the parishioners. In London and its neighbourhood, and in some other populous towns, the churchyard or parish burying-ground has been usually purchased or enlarged, or at all events is maintained at great cost by the parishioners; and although (as we have said) the freehold is in the parson, yet, by acquiescence confirmed by usage, parishes have acquired a concurrent right over the churchyard, and participate in the burial fees; which are greater according as the ground is more widely or more permanently occupied. Thus for a brick grave a greater fee is paid than for an ordinary grave; and Lord Stowell in 1821 approved a table of fees for the parish of St. Andrews, Holborn, whereby for the interment of an iron coffin 10*l.* is charged beyond the usual fee of 1*l.* 10*s.*: he mentions also in his judgment without positive disapprobation that 25*l.* extra is charged for burials in iron coffins by the parish of St. Dunstan's-in-the-West. (2 Haggard's *Consistory Reports*, 364.)

A vault cannot properly be made either in the church or churchyard, without the consent of the ordinary signified by a faculty, that is, a licence or permission, for that purpose; and this he does not grant until he has given the parson and parishioners an opportunity to express their opinions. A vault may be attached by prescription to a mansion; or again, the proprietors of a mansion may have a prescriptive right to be interred and to erect a tablet or tombstone in the aisle or chapel appurtenant to that mansion. But it would seem that the right adheres to the mansion, not to the family; who if they cease to be parishioners relinquish their right to the vault, the use of which may be granted to others. The heir however in this and in all cases may maintain an action of trespass at the common law against any one, even the parson or ordinary, who disturbs the remains, or removes or defaces the monument of his ancestor, or the hatchment, pennon, or coat armour suspended over his grave. In some parishes the parishioners have a prescriptive right to place a stone over a grave in the churchyard upon payment of a certain fee established by custom; but nothing of height can properly be erected without the consent of the ordinary; nor can a tomb or tombstone be repaired without the leave of the churchwardens; although the granting of that leave is a mere formality incumbent on those officers.

The placing of a monument in the church or a tablet on its walls is also within the jurisdiction of the ordinary; for the fixing of it in the chancel the consent of the rector is required, yet a lay rector has not a right to erect a monument or construct a vault there without a faculty from the ordinary. To remove without the ordinary's consent a monument or tablet once erected is an offence which subjects to prosecution before the ecclesiastical courts the party committing it, even though he should have himself erected the monument, and should have the consent of the incumbent for its removal.

As the erection of a tombstone, so the inscription upon it is a matter of ecclesiastical discipline, and an epitaph is unquestionably unlawful which is contrary to the canons or constitutions of the church in force at the time when the inscription is made. Thus when in a recent case the inscription 'Pray for the soul of A. B.' was objected to in the Ecclesiastical Court as recognising the doctrine of purgatory, the judge (whilst he deemed that prayers for the dead are not contrary to the canons, and therefore that the epitaph was not unlawful) distinctly affirmed the doctrine, that any new epitaph opposed to the doctrines of the Church of England might be removed, and the inscription of such an epitaph would subject the party who inscribed it to ecclesiastical censure.

(Haggard's *Consistory Reports*, i. 14, 205; ii. 333; Curteis's *Ecclesiastical Reports*, i. 880; Burn's *Ecclesiastical Law*, article 'Burial;' and Rogers's ditto.)

TOMLINE, GEORGE, eldest son of George and Susan Pretyman, was born on the 9th of October, 1750, at Bury St. Edmund's, Suffolk, and was educated at the grammar-school in that town, which was the place of education at that time of most of the gentlemen's families in Suffolk. At the age of eighteen he was sent to Pembroke Hall, Cambridge. He took his degree of A.B. in January, 1772, and obtained the high honour of senior wrangler, and at the same time the first of Dr. Smith's mathematical prizes. In the year 1773 he was elected Fellow of his college, and was immediately appointed tutor to Mr. Pitt. He was ordained deacon by Dr. Younge, bishop of Norwich, and priest by Dr. Hinchliffe, bishop of Peterborough. In 1775 he proceeded M.A., and in 1781 discharged the important office of moderator in the university. He resided in college till 1782, when he left it for the purpose of acting as private secretary to Mr. Pitt, on his appointment to the chancellorship of the exchequer. When Mr. Pitt was made first lord of the treasury, Tomline became his secretary, and he continued with him till he became bishop of Lincoln and dean of St. Paul's. Dr. Pretyman's first preferment was a sinecure rectory of Corwen in Merionethshire, to which he was collated in 1782; and in 1784 he was appointed to a prebendal stall in Westminster, the first preferment of which Mr. Pitt had the disposal. In 1785 he was presented by the king to the rectory of Sudbourn-cum-Offord, in his native county of Suffolk. In January, 1787, he was advanced to the bishopric of Lincoln and the deanery of St. Paul's, which were vacated by the promotion of Dr. Thurlow to the see of Durham, the first bishopric which became vacant after Mr. Pitt was minister. In 1813 he refused the see of London, and continued bishop of Lincoln 32½ years, in which time he performed the visitation of that most extensive diocese in the kingdom eleven times, at the regular interval of three years, which was never done by any of his predecessors. In July, 1820, he was translated to the see of Winchester, in which he continued till September, 1827, the time of his death. His publications, besides single sermons, are 'The Elements of Christian Theology,' in two volumes, now a standard work; 'A Refutation of Calvinism,' in one volume; and 'Memoirs of Mr. Pitt,' in three volumes, 8vo. Bishop Pretyman in 1803 assumed the name of Tomline, Marmaduke Tomline, Esq., having, without any relationship or connection, left him the valuable estate of Riby Grove in Lincolnshire.

TOMMA'SI, GIUSEPPE MARI'A, born of a noble family at Alicata in Sicily, in 1649, entered the congregation of the Teatini at Palermo, in 1664. He was sent to finish his studies at Rome, where he became acquainted with Cardinal Francesco Barberini, who, perceiving in him a particular disposition for the study of ecclesiastical history and antiquities, encouraged him in this pursuit, and obtained for him access to the archives of the Vatican and other repositories of church history. In 1680 Tommasi published the collection 'Codices Sacramentorum nongentis Annis Vetustiores,' which he illustrated with introductory notices. In 1683 he published an edition of the 'Psalterium,' and in 1686 a collection of 'Antiphonaries' and 'Responsoriales' of the Roman church, illustrated with learned comments and valuable documents. He afterwards edited the antient mass-books, a Latin version of the Greek ritual for Good-Friday, a new edition of the 'Psalterium,' a collection of minor works of the fathers in three volumes, to serve as an introduction to theological studies, and another book also to assist the students of divinity, entitled 'Indiculus Institutionum Theologicarum.' Tommasi and his contemporary Cardinal Bona of Mondovi. author of

'Rerum Liturgicarum Libri duo,' and 'De Divina Psalmodia,' are among the principal illustrators and expounders of the liturgy and ceremonies of the church.

In 1712 Tommasi was made a cardinal, a dignity which he at first declined, until the pope expressly commanded him to accept it. He died in the beginning of the following year.

(Tiraboschi, *Storia della Letteratura Italiana*, vol. viii., part i., b. 2.)

TOMSK. [SIBERIA.]

TON or TUN. In modern English spelling the *ton* is a weight (twenty hundredweight, or 2240 pounds averdupois) and the *tun* is a measure of wine (two pipes, or 252 gallons). Accordingly, some have supposed that the measure was derived from the weight, and in fact a *tun* of water weighs about a *ton*. But a very little consideration of the manner in which *tonna* and *tunna* were used is enough to convince any one that the weight was derived from the measure. These words are not classical, but they occur frequently in middle Latin (see Ducange, *in verb.*), and always as signifying a large cask. The hollow empty sound made by striking a large cask may have given rise to the name: we have often heard them say *ton* as plain as a cask could speak. The diminutive is *tonnella*, which was often used, but not much in England: the Commissioners of Weights and Measures found it only in Cardiganshire, standing for sixteen bushels of lime. The modern use of the word tunnel is now familiar enough. The old taxes of tonnage and poundage are enough to create a suspicion that the ton was originally a measure. This phrase would be tautology if tonnage meant a tax upon weight: we must understand tonnage and poundage to be a tax on measure and a tax on weight.

There are many local tons of weight which have sprung up in modern times.

TONBRIDGE. [KENT.]

TONE. The technical use of this word may be seen in SCALE, TETRACHORD, &c., in which it signifies a musical interval. In common language it refers to the quality of a musical sound, as when we speak of a fine-toned instrument.

TONGA ISLANDS. [FRIENDLY ISLANDS, vol. x., p. 476.]

TONGUE. The human tongue has a very complex structure, in correspondence with the variety of its offices as an organ both of sensation and of voluntary motion. The sensations which are perceived by means of the tongue are of two kinds, namely, that of taste and that of touch or tact; its motions are chiefly subservient to speech and to the prehension and swallowing of food. The sensitive apparatus of the tongue is contained in the membrane which covers it; its motor apparatus forms its interior.

The form and other external characters of the tongue may be easily observed by the aid of a mirror. Its surface is covered by a membrane continuous at the sides and lower part with that which lines the mouth and cheeks, and covered by a fine cuticle which is constantly kept moist by the saliva and by the secretion from the tongue itself. The membrane on the inferior surface of the tongue is thin, smooth, and transparent; at the middle line it forms a vertical fold which extends nearly to the tip of the tongue, and is named the frænum linguæ. The membrane on the sides and upper part of the tongue is thicker and more vascular, and bears the papillæ, the most sensitive parts, which are thickly set over its whole surface.

The papillæ of the tongue are of three different kinds:—1, The papillæ vallatæ, or magnæ, are usually seven or nine in number, but sometimes are as many as twenty or as few as three. They are situated at the back part of the tongue, in two rows forming an angle, like the letter V, with its apex directed backwards. Each of them has the form of a truncated cone, and consists of a number of fine cylindrical processes closely held together. They are set in rather deep depressions of the membrane, so that they seem to be surrounded by fossæ which are bounded by elevated rings. 2, The fungiform or lenticular papillæ are smaller, but much more numerous than the preceding, and are scattered at irregular distances from each other over the whole of the upper surface and sides of the tongue. They vary in form, some being hemispherical, some nearly cylindrical, and some having narrow stems which support larger summits, so as to have somewhat the shape of mushrooms. These also, like the preceding kind, are composed of numerous delicate filaments closely united. 3, The conical and filiform papillæ cover all the remaining parts of the upper surface and sides of the tongue. They are so thickly set that at first sight the tongue seems nearly smooth. They form little elevations on the membrane with sharp points which are directed backwards, so that the tongue feels smooth when the finger is passed over it from before backwards, but rough when it is passed in the opposite direction.

All these papillæ are very vascular, and receive filaments of the sensitive nerves of the tongue. Their structure is similar to that of the sensitive papillæ of the skin [SKIN], except that the cuticle covering them is much thinner; and their chief office is also similar, but it is probable that each kind of papillæ is subservient to a different kind of sensation. The conical papillæ moreover are not merely sensitive organs: by the roughness which they give to the tongue, they make it a more secure instrument of prehension; and by their being directed backwards, they fit it for the conveyance of food and drink towards the throat. In the cat tribe and many other animals, similar, but much larger and stronger, papillæ serve both for the lapping up of liquids and for the raising or scraping up of the smaller particles of food. The lion, tiger, and many other carnivora use them like rasps for tearing off the last fibres that adhere to bones; and they are employed by numerous mammalia as combs for the cleaning of their skins and hair. They are the better adapted for all these purposes by being covered by a much harder cuticle than that which invests the papillæ of the human tongue.

The interior of the tongue is composed entirely of muscles, and of the fat and cellular tissue which lie between their fibres. These muscles are named, after the parts to which they are attached, the hyo-glossi, stylo-glossi, genio-hyo-glossi, and linguales. The hyo-glossi are the two muscles which form the outer and lower parts of the tongue. They arise from the sides of the hyoid bone [LARYNX: SKELETON], whence they proceed upwards and outwards to the sides and root of the tongue. In the latter situation their fibres mix with those of the stylo-glossi muscles, which arise from the styloid processes of the temporal bones, and pass forwards, expanding towards the sides and apex of the tongue. Both the stylo-glossi and the hyo-glossi muscles, when they contract, draw the tongue backwards and downwards; the former, acting alone, make the upper surface of the tongue concave; the latter make it convex: those of one side, acting alone, draw the tongue to the side of the mouth. The genio-hyo-glossi are two muscles whose fibres arise from processes on the posterior surface of the lower jaw, and thence proceed, expanding in a fan-shape, nearly straight backwards and upwards, to the under part and root of the tongue. The greater part of the fibres of each muscle enter the tongue; but a small portion of them pass somewhat downwards, and are fixed to the hyoid bone. Their office is to draw the tongue forwards (as in putting it out of the mouth), or, when the hyoid bone is fixed, to draw the tip of the tongue backwards and downwards. The linguales are two slips of muscular fibres lying near the dorsum of the tongue, between the hyo-glossi and genio-hyo-glossi, and running straight from before backwards. Their office is to shorten the tongue and draw it backwards.

But besides these muscles, and variously intermingled with their fibres, the tongue contains numerous other irregular fasciculi, of which no description can be given. It is also variously influenced by the muscles which move the soft palate and its arches and the hyoid bone. From the variously combined actions of them all, the tongue is made capable of more rapid, more varied, and (for its size) more extensive motions than any other organ in the body; but it is unnecessary to describe them, since each person may observe them in himself.

At the posterior part, or root, of the tongue, numerous small glands are imbedded in its substance. They have a structure similar to that of the labial, palatine, and others of the smaller salivary glands, and probably secrete a similar fluid, which serves to lubricate the passage for the food from the mouth to the fauces.

For its movements and its double sensibility the tongue is supplied with three different pairs of nerves:—1, The hypoglossal, or lingual, or ninth pair of nerves [BRAIN], are distributed almost exclusively in the muscles of the tongue: they are its motor nerves; and when they are paralysed, compressed, or divided, the tongue is rendered immoveable, but its sensations are unimpaired. 2, The lingual (or, as they are sometimes called, the gustatory) branches of the fifth pair of nerves are those on which the sensibility of the tongue to all common impressions of touch, heat, cold, &c. depends. They are distributed most abundantly in the papillæ at and near the tip of the tongue, and they endow it with a sensibility more acute than that possessed by any part of the skin. Professor E. H. Weber has proved this by an experiment [NERVE], showing that with the tip of the tongue two bodies may be perceived to be separate, though they be placed so close to each other that they are felt as only one body by the finger; and the same fact may be observed in the acuteness with which a minute body, such as a portion of hair, is felt by the tongue, though it is quite imperceptible to the finger. 3. The gustatory, glosso-pharyngial, or eighth pair of nerves, of which a considerable part is distributed in the tongue, are probably those on which the peculiar sense of taste depends. There are indeed some facts which it is difficult to explain, except by supposing that the lingual branch of the fifth is also a nerve of taste; but on the whole it is more probable that the functions of the two nerves are distinct, and that the fifth is in the tongue, as it is in every other part in which it is distributed, a nerve of common sensation, and the glosso-pharyngeal the nerve of taste. The numerous facts on which the question has been discussed may be found in Müller's 'Physiology,' in Carpenter's 'Physiology,' and in Valentin's essay 'De Functionibus Nervorum.' The best experiments are those by Panizza and Valentin, both of whom favour the opinion which is here expressed, and which is besides corroborated by a majority of the cases in which the tongue has been partially paralysed, and by the fact that the sense of taste is acute at the back of the tongue and the soft palate, in which the glosso-pharyngeal alone is distributed.

Much of the uncertainty of this question has arisen from the difficulty of determining when a substance is merely tasted and when it is felt. In ordinary eating we confound the impressions derived at once from smell, taste, and touch. We speak of the taste of cinnamon-bark and similar aromatic substances as if it was a simple quality; whereas if the nostrils be closed while we are eating the bark, we perceive none of its flavour or odour, but only its hardness and toughness by the sense of touch, and a burning sensation, which is also probably the result of an impression produced on the nerve of common sensation by the essential oil. Many similar examples will present themselves to the reader, who, with a little reflection, will easily analyse the sensations produced by most of the substances that are eaten or drunk.

The quality by which substances are capable of exciting the sensation of taste is altogether unknown, nor has even a probable hypothesis been formed. The best examples of merely sapid substances are the various alkaline and metallic salts, and the inodorous bitters. By experiments with these the sense of taste is found to be subject to many of the same rules as the other senses, and to be especially analogous to that of smell. [SMELL.] A certain force of application of the stimulus heightens the perception of it. Men instinctively press the tongue against the roof of the mouth and *smack* it, to obtain a clear sense of taste, as they inspire quickly in the act of smelling. Contrast of tastes also commonly makes that which is last perceived more obvious, as the eye passing from one colour to another, or the nose from one odour to another, perceives each in succession the more acutely; and there are subjective sensations of taste, as there are of sight and hearing. Such are those produced by the contact of two different metals with each other and with the tongue, and those which are perceived in various diseases; but the circumstances on which they depend are as yet unknown.

TONIC. [ANALEPTICS.]

TONNAGE AND POUNDAGE. [SUBSIDY.]

TONNEINS. [LOT ET GARONNE.]

TONNERRE. [YONNE.]

TÖNNINGEN, a small town in the Danish duchy of Schleswig, is situated in 54° 20′ N. lat. and 8° 50′ E. long., near the mouth of the river Eider. Since the completion of the canal of Kiel it has become a place of great activity, being the harbour at the western extremity of the canal, where all vessels stop, as Kiel is for the eastern. It has a pretty convenient harbour, with several wharfs, and is defended by three batteries: the depth of the water in the harbour is twelve feet, and many vessels from the Baltic are laid up there for the winter. From 500 to 600 ships come here annually, and the town has 50 ships of its own. The inhabitants, about 2500 in number, have a considerable export trade in corn and other productions of the country. There are in this town a board of quarantine, an extensive public magazine, and a royal custom-house. The blockade of the Elbe by the English, in consequence of the occupation of Hanover by the French, gave for a short time extraordinary importance to Tönningen, by making it the channel for the immense maritime commerce of Hamburg, all goods consigned to that city being landed at Tönningen, whence they were forwarded by land. The hundreds of waggons from Tönningen loaded with merchandise which crowded all the streets of Hamburg both day and night, gave that city an air of bustle and activity which it never had before, so that unexperienced persons might have fancied that its commerce had all on a sudden been considerably increased. The effect of this state of things on Tönningen may be appreciated from the fact that the import duties received at the custom-house, which had previously amounted to 20,000 or 25,000 dollars, rose during the blockade of the Elbe to 250,000 in a year.

(Stein, *Geographisches Lexicon;* H. E. Lloyd, *Hamburg.*)

TONQUIN, or TONKIN. [CHINA, vol. vii., p. 307.]

TONQUIN BEAN. [COUMAROUNA.]

TONSILS. The tonsils are two complex glands, one of which lies on each side of the fauces, between the arches of the soft palate. They are of an elongated oval form, and each is composed of a number of smaller glands aggregated together in one mass, and usually opening by several orifices on the surface of the mucous membrane. They form a continuous layer with a great number of similar glands, which are contained in the substance of the palate, in the root of the tongue, and in the space between the tongue and the epiglottis; and with these, the tonsils form a complete ring of glandular tissue around the aperture leading from the mouth to the pharynx. The nature of the fluid secreted by them is not certainly known. It bears a general resemblance to saliva, and probably serves chiefly to lubricate the food for its passage from the mouth to the stomach.

The tonsils are very subject to inflammation. In its acute form this disease constitutes the most frequent kind of sore-throat. It is often called cynanche tonsillaris, and may be distinguished from the other kinds by the tonsils being enlarged and forming bright red tumours projecting from the sides of the back of the mouth. Its treatment is the same as that of the other varieties of acute cynanche. [QUINSY.] Either after acute inflammation, or independently of it, the tonsils are also very subject to a chronic enlargement, which gives rise to a permanent difficulty of swallowing, with a peculiar nasal tone of voice, and often considerable dyspnœa. With the last symptom there is often combined a peculiar loud snoring during sleep; and, in children, it produces a deformity of the chest by the elevation and increased convexity of the sternum, which are the consequence of the habitually increased efforts of inspiration. This disease is very frequent in scrofulous persons, especially during childhood, and may sometimes be cured by attention to the general health, and by the use of powerful astringent or acid gargles; but, in general, the quickest and best remedy is to cut off the prominent portions of the tonsils, an operation which is scarcely painful, and may be performed either with a blunt-pointed knife, or with an instrument lately invented, called a guillotine. With the latter the enlarged tonsil is first passed through a ring, then fixed by a needle which is run through its centre, and lastly is cut off by the stroke of a sharp blade driven through its base. The operation seldom needs to be repeated; the wounded surface quickly heals, and the tonsil ceases to grow. In very acute cases of inflammation of the tonsils abscesses are frequently formed within them. They should be opened early, and the after-treatment may be similar to that for other sore-throats. The tonsils also usually partake of the inflammations and other diseases, such as cancer, syphilis, the local affection in scarlet fever, &c., which attack the adjacent parts.

TONSILS, DISEASES OF THE. [QUINSY.]

TONSTALL, or TUNSTALL, CUTHBERT, was born at Hatchford, in Yorkshire, in 1474 or 1475. It has been commonly stated that he was a natural son of a gentleman of antient family, who, according to one account, was Sir Richard Tonstall. His mother is said to have been a lady of the Conyers family. It has been doubted however whether there be any foundation for this story. About 1491 he was sent to the university of Oxford, where, according to some authorities, he was entered a student of Baliol College; but the plague soon drove him to Cambridge, where he is known to have eventually become a fellow of King's Hall (now incorporated with Trinity College). After this he went abroad and studied at Padua, and having there taken the degree of doctor of laws, returned to England with the highest reputation for classical, legal, and scientific, as well as for theological learning. His first patron was Warham, Archbishop of Canterbury, who, in 1511, made him his vicar-general, collated him to the rectory of Harrow-on-the-Hill, and also introduced him at court. In 1514 he was promoted to a prebend in the cathedral of Lincoln; in 1515 he was admitted archdeacon of Chester; and in May, 1516, he was appointed master of the rolls, an office at this date often held by clergymen. Towards the close of this same year he was sent to Brussels as chief commissioner to Charles, the young king of Spain and the Low Countries (afterwards the emperor Charles V.), with whom he concluded two treaties of alliance and commerce; and here he made the acquaintance of Erasmus, who describes him, in one of his letters, as not only the most eminent Greek and Latin scholar among his countrymen, but also a person of the most comprehensive judgment and the nicest taste, and withal of remarkable modesty and the most agreeable and cheerful manners, yet without going beyond the bounds of a becoming gravity. Erasmus adds that, much to his delight, he boarded at the same table with Tonstall. In 1517, within ten days after his return home, he was sent on a second embassy to Charles. In 1519 he was collated to a prebend in the cathedral of York; and in 1521 to another in that of Salisbury, of which diocese he was also at the same time elected dean. The next year he was promoted to the bishopric of London: his consecration took place on the 9th of October, his enthronization on the 22nd. He now resigned his office of master of the rolls; but in May, 1523, he was introduced into the government by being made lord privy seal. After this he was employed in various diplomatic missions: having been sent to Spain on an embassy to the emperor in 1525; having accompanied Cardinal Wolsey in his embassy to France in 1527; and having along with Sir Thomas More represented the English king at the negotiation of the treaty of Cambray in 1529. At Antwerp, on his return from Cambray, Tonstall, as the story is related by the old chronicler Hall, purchased from an English merchant named Packington all the copies that remained unsold of Tyndal's translation of the New Testament, and bringing them home with him, made a bonfire of them in Cheapside—the effect of which was to enable Tyndal to publish next year a second and more correct edition with the bishop's money. In 1530 Tonstall was translated to the bishopric of Durham: and now, or soon after this, he appears to have resigned the privy seal. In the religious changes that now began to be enforced by the royal authority, his mild and compliant temper carried him nearly as far as Henry himself went: he supported the divorce of Queen Catherine (although it has been supposed that he latterly somewhat changed his opinion on that question); he preached and wrote in favour of the king's assumption of ecclesiastical supremacy; and, along with Heath, bishop of Rochester, he revised the English translation of the Bible which was published by authority in 1541. But, from habit, conscientious belief, or love of quiet, he appears to have retained to the last an attachment to most of the doctrinal theology of the antient church. Yet, like the generality of the other bishops, he acquiesced in the additional innovations of all kinds that were made in religion on the accession of Edward VI., in 1547; and accordingly he not only preserved his seat in the privy council, but was also made a member of the king's council in the north. In May, 1551, however, he was accused before the council of being privy to the design of an insurrection in the north; upon which he was in the first instance commanded to keep his house; and afterwards, on a letter in his handwriting, deemed to be confirmatory of the charge, being found among the papers of the Duke of Somerset, which were seized in December of that year, he was committed to the Tower, and a bill was brought into the House of Lords to deprive him of his bishopric. But, although the bill was passed by that house, all the influence of the new head of the government, the Duke of Northumberland, proved insufficient to satisfy the objections of the Commons, and they refused to proceed with it. The precise nature of the charge is not known; and it seems highly improbable, from Tonstall's character, that he should have involved himself in any insurrectionary or other treasonable scheme. In the Lords the bill was strongly opposed by Cranmer, who 'spoke so freely against it,' says Burnet, 'that the Duke of Northumberland and he were never after that in friendship together.' The duke however was not to be cheated of his prey: the parliament was dissolved in April, 1552; but on the 21st of September thereafter a commission was issued to the chief justice of the King's Bench and seven others, empowering them to call Tonstall before them, to examine him touching all manner of conspiracies, &c., and, if they found him guilty, to deprive him of his bishopric; and by this tribunal he was in fact deprived on the 14th of October.

He remained a prisoner in the Tower for the remainder of King Edward's reign; and the bishopric of Durham having been dissolved by act of parliament, in April, 1553, Northumberland obtained a grant of the greater part of its jurisdiction and revenues, with the title and dignity of Count Palatine. In a few months however the accession of Mary again changed everything; and Tonstall, released from prison, was reinstated in his bishopric, which the queen erected anew by letters-patent. His own sufferings had not given Tonstall any taste for persecution; and he principally distinguished himself throughout this reign by the moderation of his conduct and the aversion he showed to the violent courses urged by the court and followed with little reluctance by most of his right reverend brethren. No burnings of heretics took place in his diocese; and, suspected on this account to be half a Protestant at heart, he lived under a cloud in so far as regarded the favour of the court. Nevertheless when Elizabeth came to the throne he refused to take the oath of supremacy; and he was deprived on that account, in July, 1559. Being committed to the charge of his friend Parker, already nominated, though not admitted, archbishop of Canterbury, and in possession of Lambeth, Tonstall 'lived there,' says Lloyd (in his 'State Worthies'), 'in sweet chambers, warm beds, by warm fires, with plentiful and wholesome diet, at the archbishop's own table; differing nothing from his former grandeur, save that that was at his own charges, and this at another's; and that he had not his former suite of superfluous servants—that long train, that doth not warm, but weary the wearer thereof.' Tonstall only enjoyed Parker's hospitality for a few months: he died on the 18th of November, 1559.

The character of Tonstall may be collected from this sketch of his history. He will scarcely be allowed the credit of principle by the more severe class of moralists; but although not made to be a martyr, he had evidently many excellent moral qualities. Intellectually he was rated very high in his own day: Erasmus, More, Warham, Cranmer, and Parker were all among his admirers and attached friends. Besides various scattered letters, speeches, and other short compositions, some in print, some in manuscript, for a list of which we must refer to the 'Biographia Britannica,' Bishop Tonstall is the author of the following works, published by himself:—1, 'In Laudem Matrimonii,' &c. (a Latin Oration pronounced at the betrothment of the Princess Mary and Francis, eldest son of the king of France), 4to., Lond., 1518; 2, 'De Arte Supputandi Libri Quatuor' (a treatise on Arithmetic), 4to., Lond., 1522, and frequently reprinted at Paris, Strasburg, and elsewhere on the Continent, as well as in England. The writer of 'Notices of English Mathematical and Astronomical Writers between the Norman Conquest and the year 1600,' in the 'Companion to the Almanac for 1837,' says, 'In point of simplicity this work stands alone in its age, and is perfectly free from all the extraneous matter which was often introduced into the scientific works of the day.' 3, A Sermon preached on Palm-Sunday, 1538, before King Henry VIII. on *Philippians*, ii. 5-12 (in support of the royal supremacy), 4to., Lond., 1539, and again 1633; 4, 'De Veritate Corporis et Sanguinis Domini Nostri Jesu Christi in Eucharistia' (in defence of Transubstantiation), 4to., Paris, 1554; 5, 'Compendium et Synopsis,' &c., an abridgment of Aristotle's Ethics, 8vo., Paris, 1554; 6, 'Contra Impios Blasphematores,' &c., a defence of Predestination, 4to., Antwerp, 1555; 7, 'Godly and Devout Prayers in English and Latin,' 8vo., 1558.

TONSURE (from the Latin, *tondere*, 'to clip') is the name given to a distinguishing mark of the clergy of the Roman Catholic church, formed by cutting off a portion of the hair from the head. Mention is made of polled or shaven crowns in connection with the clerical character in the earliest ages of the church; but it seems to be clear that this has nothing to do with the modern tonsure: the practice of shaving the head or wearing the hair too short is in fact condemned in priests by Jerome and others of the Fathers. (Bingham's *Origines Ecclesiasticæ*, b. vi., c. iv., s. 16.) What is now called the tonsure was probably introduced not earlier than the latter part of the fifth century. Various explanations of its mystical meaning have been proposed: one theory is, that it is a sign of adoption by the church; another, that it is intended to symbolize the clerical subjection and obedience; another, that it is a memorial of the Saviour's crown of thorns, &c. According to the existing and long-established practice, the tonsure is formed by clipping away the hair from a circular space on the back of the head. The application of the scissors by the bishop to remove the first tuft is the initiatory rite by which persons are received into the clerical order. Of course the clerical crown, as it is called, must be preserved by repeated trimming when necessary; and the practice, we believe, is to enlarge it as the wearer rises in ecclesiastical station and dignity. The present however was not the universal form of the tonsure in former times. When the missionaries who had come over to Britain from Rome encountered in the seventh century the Scottish and Irish priests, they were horrified by observing that instead of a circular tonsure on the occiput, they were distinguished by a tonsure in the shape of a crescent on the forehead. The Roman missionaries asserted that this was the sort of tonsure worn by Simon Magus and his disciples. The true form of the tonsure and the proper mode of calculating Easter were the chief subjects of theological controversy in this island in the latter part of the seventh and the beginning of the eighth centuries.

TONTINE, a species of life annuity, so called from Lorenzo Tonti, a Neapolitan, with whom the scheme originated, and who introduced it into France, where the first tontine was opened in 1653. The subscribers were divided into ten classes, according to their ages, or were allowed to appoint nominees, who were so divided, and a proportionate annuity being assigned to each class, those who lived longest had the benefit of their survivorship, by the whole annuity being divided amongst the diminished number. The terms of this tontine may be seen in the French 'Encyclopédie' ('Finance' division, vol. iii., p. 704). In 1689 a second tontine was opened in France. The last survivor was a widow, who, at the period of her death, at the age of 96, enjoyed an income of 73,500 livres for her original subscription of 300 livres. The last French tontine was opened in 1759. They had been found very onerous, and in 1763 the Council of State determined that this sort of financial operation should not be again adopted. Tontines have seldom been resorted to in England as a measure of finance. The last for which the government opened subscriptions was in 1789. The terms may be seen in Hamilton's 'Hist. Public Revenue,' p. 210. There have been numerous private tontines in this country. Hamilton remarks (p. 61) that 'Tontines seem adapted to the passions of human nature, from the hope every man entertains of longevity, and the desire of ease and affluence in old age; and they are beneficial to the public, as affording a discharge of the debt, although a distant one, without any payment.' Some payments, on account of subscribers to English and Irish tontines, remain still a small charge upon the public debt.

TOOKE, JOHN HORNE, was the son of John Horne, a poulterer in Newport-street, Westminster, where he was born on the 25th of June, 1736. The name of Tooke he assumed afterwards for reasons mentioned below. He was educated at Westminster and Eton schools, at the former of which he remained two, and at the latter five years. In 1755 he went to St. John's College, Cambridge, and took his degree of B.A. in 1758. After leaving Cambridge he officiated for a short time as usher in a school at Blackheath, and in 1760 took deacon's orders, and obtained a curacy in Kent. He entered the church through the wishes of his father, but against his own inclinations. He had wished himself to study for the bar, and with this view had entered his name at the Inner Temple in 1756. In 1760 he received priest's orders; and in the course of the same year was inducted to the chapelry of New Brentford, which his father had purchased for him. He was however never happy in discharging the duties of his profession, and gladly embraced the opportunity of leaving New Brentford for more than a year upon two different occasions, in order to travel on the Continent as tutor to the sons of gentlemen in his neighbourhood. What he thought of his profession may be seen from a letter of his to Wilkes, whose acquaintance he made in Paris in 1765, and to whom he thus writes: 'You are now entering into correspondence with a parson, and I am greatly apprehensive lest that title should disgust; but give me leave to assure you, I am not ordained a hypocrite. It is true I have suffered the infectious hand of a bishop to be waved over me; whose imposition, like the sop given to Judas, is only a signal for the devil to enter. I hope I have escaped the contagion; and, if I have not, if you should at any time discover the black spot under the tongue, pray kindly assist me to conquer the prejudices of education and profession.'

On his second return from the Continent in 1767, Horne took an active part in the political contests of the day, and it was greatly owing to his exertions that Wilkes was returned as member for the county of Middlesex in 1768. Horne's opposition to the ministry was unceasing, and he soon became one of the most popular men of the day. He was the founder of the 'Society for supporting the Bill of Rights,' in 1769, in which he was closely associated with Wilkes; but in the following year a quarrel took place between them, which led to an angry paper war, in consequence of which Horne lost much of his popularity.

In 1771 he took his degree of M.A., which was granted to him, notwithstanding the opposition of many of the members of the university, and among others of Dr. Paley. His quarrel with Wilkes drew upon him in the same year the attack of Junius, whom he answered with considerable success.

His occupations were now so entirely opposed to the clerical profession, and his dislike to it had become so great, that he resigned his living in 1773 with the view of studying for the bar. That he might not want the means of doing so, four of his friends presented him with joint bonds to the amount of 400*l*. a year, which were to continue in force till he was called to the bar. While prosecuting his legal studies, he afforded great assistance to Mr. William Tooke, an old friend of his, in resisting an inclosure bill, which would have greatly deteriorated the value of some property which Tooke had purchased at Purley, near Godstone in Surrey. In return for his services Mr. William Tooke made him his heir; and it was upon this occasion or shortly afterwards that he assumed the name of Tooke, by which he is commonly known.

On the breaking out of the American War, Tooke vehemently attacked the conduct of the ministry, and opened a subscription for the widows and orphans of the Americans, 'murdered,' as he said, 'by the king's troops at Lexington and Concord.' The ministry prosecuted him for a libel in 1777; he was found guilty, condemned to pay a fine of 200*l*., and to be imprisoned for twelve months. While in prison he published his letter to Mr. Dunning, which is occupied with a critical examination of the case of 'The King and Lawley,' which had been quoted as a precedent against him in his trial: this examination leads him to explain the conjunctions and prepositions of the English language. This letter formed the basis of a considerable part of the first volume of the 'Diversions of Purley.'

Shortly after his release from prison, he applied in 1779 to be called to the bar, but he was rejected by the benchers on the ground of his being a clergyman. This blighted all his prospects in life, and he soon afterwards retired from London to a farm in Huntingdonshire. He had however previously published, in conjunction with Dr. Price, a pamphlet against the American War, entitled 'Facts' addressed to the landholders, stockholders, &c. of Great Britain. Tooke did not remain long in Huntingdonshire, and on his return to London he took an active part in advocating the cause of parliamentary reform, which Mr. Pitt then espoused. He published a letter in favour of it in 1782, addressed to his friend Mr. Dunning, then Lord Ashburton. He continued to advocate Mr. Pitt's party steadily for some years, and when Mr. Fox came into power by the coalition ministry, as it was called, he published his celebrated 'Two Pairs of Portraits,' 1788, in which he contrasts the character and conduct of Lord Chatham and Lord Holland, and of Mr. Pitt and Mr. Fox respectively. Two years previously to this he published the first volume of his 'Επεα Πτεροεντα,' or the 'Diversions of Purley,' in octavo, the latter of which names was given to the work in compliment to the residence of his friend Mr. William Tooke.

In 1790 Tooke became a candidate to represent the city of Westminster in parliament; and though he spent nothing upon the contest, he polled nearly 1700 votes. In 1794 he was arrested on a charge of high treason, mainly as it appears on account of his connection with the 'Constitutional Society.' Nothing however of a treasonable nature could be proved against him, and he was accordingly acquitted after a trial which lasted six days, during which he distinguished himself by his calmness, intrepidity, and presence of mind. His domestic affairs having become very much embarrassed, his friends came forward to his assistance and settled on him a pension of 600*l*. a year. In 1796 he again offered himself as a candidate for Westminster, and polled on this occasion upwards of 2800 votes. His desire of obtaining a seat in parliament was at length gratified, though not exactly in a way which best accorded with the principles of a person who had been such a strenuous advocate of parliamentary reform. He was returned in 1801 for the borough of Old Sarum by Lord Camelford. He retained his seat till the dissolution of parliament in the following year, but was disqualified from sitting again in consequence of an act of parliament, which was passed while he was in the house, enacting that in future no one in priest's orders should be a member of the House of Commons.

Mr. Tooke now retired into private life, and passed the remainder of his life at Wimbledon, where he had already resided for many years. He had published a second edition of the 'Diversions of Purley' in 1798, in one volume, quarto, and this was now followed by the second volume in 1805. He died on the 18th of March, 1812, in the 77th year of his age. He was never married, but had several illegitimate children, to one of whom he left his property.

Mr. Tooke was a man of great powers and considerable attainments. He was well read in English, French, and Italian literature, possessed a tolerable knowledge of Latin and Greek, and had studied Anglo-Saxon with some diligence. In private he was much beloved, and his conversational powers are particularly celebrated by all who knew him. He is however principally known in the present day by the 'Diversions of Purley,' a work which has exercised considerable influence upon almost all works on the English language published since its appearance. It is written in the form of a dialogue: the principal speakers in the first volume are Mr. Tooke himself, and his friend Dr. Beadon, the Master of Jesus College, Cambridge; Mr. William Tooke is occasionally admitted to take part in the dialogue: in the second volume the only speakers are the author and Sir Francis Burdett. The first volume is divided into ten chapters: the first treats 'Of the Division and Distribution of Language;' the second contains 'Some Considerations of Mr. Locke's Essay on the Human Understanding;' the third treats 'Of the Parts of Speech,' in which all words necessary for the great purposes of speech are resolved into 'words necessary for the communication of our thoughts,' and 'abbreviations employed for the sake of dispatch;' in respect to the former we are told that in English and in all languages there are only two sets of words necessary for the communication of our thoughts, and that these are nouns and verbs. The fourth chapter treats 'Of the Noun,' and the fifth 'Of the Article and Interjection.' The substance of the three next chapters, 'On the word That,' 'Of Conjunctions,' and 'Etymology of English Conjunctions,' had been previously given in the letter to Mr. Dunning. The tenth chapter speaks 'Of Adverbs.' In the second volume, the first chapter treats 'Of the Rights of Man;' the second, third, fourth, and fifth, 'Of Abstraction;' and the sixth, seventh, and eighth, 'Of Adjectives and Participles.' It is impossible to read this work without deriving information from it. It contains many happy explanations and conjectures, but the young student cannot be cautioned too strongly against receiving all the conclusions of the author. The great fault of the book is the love of hypothesis, and the absence to a great extent of that historical mode of investigation without which etymological studies are worse than useless. A useful edition of the work has been published by Richard Taylor, with notes, London, 1840.

(Stevens's *Life of Tooke.*)

TOOKE, REV. WILLIAM, F.R.S., was born on the 18th of January, 1744, and educated at a private academy at Islington, kept by Mr. Shield, where he had for schoolfellows the indefatigable and amiable antiquarian Mr. John Nichols, and Dr. Ed. Gray of the British Museum, Sec. R. S., with each of whom he kept up a cordial intimacy during their lives. He was ordained a clergyman of the church of England in 1771, by the then bishop of London, and shortly afterwards obtained the situation of minister of the English church at Cronstadt, the naval arsenal and commercial port of St. Petersburg. In 1774 he was appointed chaplain to the factory of the Russia Company at St. Petersburg, in which situation he remained for eighteen years. He often preached in the chapel of the French Protestants at St. Petersburg in the French language, of which he was a complete master; and after his return to London he preached on several occasions in that language on behalf of the French Protestant School and Workhouse in London. He returned to England in 1792, in consequence of succeeding to a considerable property by the death of a maternal uncle, which enabled him to dispense with all professional exertion. He died in London, November 17, 1820, in his seventy-seventh year, much esteemed by a large circle of literary friends. By his wife Elizabeth, daughter of Thomas Eyton, Esq., of Llangynhavil in Denbighshire, he had a daughter and two sons, who survived him.

Mr. Tooke was the author of several works, of which the most important are those relating to Russia, namely, a 'Life of Catherine II.,' 3 vols. 8vo.; 'A View of the Russian Empire,' 3 vols.; and 'A History of Russia, from the Foundation of the Empire to the Accession of Catherine II.' Mr. Tooke was also a joint editor with Archdeacon Nares and Mr. Beloe, of the 'General Biographical Dictionary,' in 15 vols. 8vo., 1798; his portion of the work was the first five volumes. Besides this he published, early in life, 'Othniel and Achsah,' an Oriental tale from the Chaldee, in 2 vols., and long afterwards four volumes of miscellaneous essays under the titles of 'Varieties of Literature,' and 'Selections from various Foreign Literary Journals.' He translated Zollikofer's sermons from the German, in 10 vols. 8vo., and Lucian's works, in 2 vols. 4to., with the notes of Wieland. The Lucian however is not a translation from the original Greek, but from Wieland's version; and where the latter did not give the meaning of the Greek, recourse was had to the original.

(Nichols's *Literary Anecdotes*; and *Gentleman's Magazine* for May, 1816; November, 1820; and December, 1839.)

TOON-WOOD is extensively employed in India for making furniture and cabinet-work. It is sometimes called Indian mahogany, and sometimes Indian cedar. It is of a reddish-brown colour and rather coarse-grained. The tree has been named Cedrela Toona by botanists, and is supposed to be the same which yields the so-called cedar-wood of New South Wales, which is also red in colour and coarse-grained. These somewhat resemble what is called Havannah or Barbadoes cedar, which is the wood of another species of the same genus—the Cedrela odorata of Linnæus. This wood is imported in considerable quantities from the island of Cuba, and is often used for the insides of drawers and wardrobes. The cigar-boxes from Havannah are said to be made of this kind of cedar.

The genus Cedrela has been so named from Cedrus, and belongs to the natural family of Cedrelaceæ, which is sometimes considered only a tribe of Meliaceæ. Many of the Cedrelaceæ are remarkable for the excellence of the timber which they yield, as, for instance, the mahogany, the satin-wood, and the chikrasee of India. Many of the species are remarkable for their bitterness and astringency, and hence several are employed as stomachics and febrifuges; as Khaya Senegalensis, on the banks of the Gambia; Seymida febrifuga, in India; and Cedrela febrifuga in Java, as well as C. toona in India.

TOONGOOSES. [SIBERIA.]

TOORBUT. [Persia.]

TOORINSK. [Siberia.]

TOORSHISH. [Persia.]

TOPAZ occurs massive, in imbedded and rounded crystals. Primary form a right rhombic prism. Cleavage easy, parallel to the base of the primary form, more difficult in the direction of its lateral faces. Structure lamellar at right angles to the axis of the prism. Fracture uneven, slightly conchoidal. Hardness: scratches quartz. Electricity—positive by friction; those crystals which possess different faces of crystallization at opposite ends, acquire different kinds of electricity at the two extremities when heated. Colour: white, yellow, bluish, and greenish. Lustre vitreous, transparent, translucent. Specific gravity 3·499. Fragments exposed to heat emit a blue, green, or yellowish phosphoric light. By the blow-pipe on charcoal does not fuse, but with borax it melts into a transparent glass. Topazes occur generally in primitive rocks, and in many parts of the world, as Cornwall, Scotland, Saxony, Siberia, Brazil, &c. &c.

The following analyses have been given of this mineral: (1) Saxon topaz by Klaproth, (2) Brazilian topaz by Klaproth, (3) Saxon topaz by Berzelius, (4) Brazilian topaz by Berzelius:—

	(1)	(2)	(3)	(4)
Silica . . .	35	44·5	34·24	34·01
Alumina . .	59	47·5	57·45	58·38
Fluoric acid .	5	7·0	7·75	7·79
Oxide of iron .	..	0·5	..	..
	99	99·5	99·44	100·18

TÖPLITZ. [Teplitz.]

TOPOGRAPHY (from the Greek *τοπογραφία*, which is from *τόπο,ς*, 'a place,' and *γράφ,ειν*, 'describe'). Perhaps the nearest corresponding combination of English words would be 'place-description.' The word Topography is limited by usage to the description of cities, towns, villages, castles, churches, and other artificial structures, including notices of everything belonging to the places or connected with them; for instance, not only the site, construction of the streets, public buildings, &c. of cities and towns, but the number of inhabitants, trade, history, and so forth. The word occurs in the Greek writers. Cicero (*ad Attic.*, i. 13) uses *Topothesy* (*τοποθεσία*) as synonymous with topography, though topothesy should have a different meaning. (See an 'Essay on the Study of Geography,' by George Long, in the *Schoolmaster*, vol. ii.) In the Greek 'topography' has a wider meaning than it has with us. But a description of a given place, with reference to its physical character, hardly comes within our notion of a topographical description, which is generally, at least, limited as above stated.

TOPSHAM. [Devonshire.]

TORBAY. [Devonshire.]

TORCELLO. [Venice.]

TORDENSKIOLD, Vice-Admiral in the Danish navy. His name was Peter Wessel before he was ennobled by King Frederick IV. Born on the 28th October, 1691, at Trondhiem in Norway, of obscure parents, he was at an early age bound apprentice to a barber, but his strong desire for a seafaring life induced him to leave his master and go to Copenhagen as cabin-boy. There he entered the service of the East India Company as a common sailor, and in his third voyage distinguished himself so much, that by the recommendation of his captain he obtained an appointment as midshipman in the royal navy. In the year 1709, immediately after the battle of Pultawa, Denmark declared war against Sweden, and from that time Wessel's brilliant career commenced. From 1709 to 1711 he commanded a small privateer, and made many prizes. He was promoted to the rank of lieutenant in 1712, and shortly afterwards had the command of a small frigate, in which he cruised against the Swedish traders with such effect, that it is said the Gothenburg and Calmar merchants offered him a hundred thousand crowns if he would resign his command. On the 5th of June, 1712, he met a Swedish frigate of nearly double the size of his own, under English colours. Tordenskiold hoisted the Dutch flag, and by a skilful manœuvre laid alongside the enemy within hailing distance, and the Swedish captain, still believing him to be Dutch, hailed him. The answer was a destructive broadside. A most obstinate engagement ensued, in which Tordenskiold had decidedly the advantage, when he unfortunately found that his ammunition was exhausted. Upon this he hailed the Swedish captain, telling him the roughness of the sea alone prevented him from boarding the frigate and taking her; but that if he either would lend him some powder or pledge his word to await his return within three days off the Drammen, he would promise to carry him as a prize to Copenhagen. Both proposals were declined, but the Swedish captain expressing a lively wish to become personally acquainted with his gallant adversary, Tordenskiold went on board to him, and drank to the king of Sweden's health. Upon his return to Copenhagen he was tried by a court-martial, but honourably acquitted; and King Frederick, pleased with his chivalrous conduct, promoted him to the rank of captain. During his stay in Copenhagen he submitted to the king personally a plan for attacking the Swedish coast, which the Admiralty however, being somewhat alarmed at the young man's rapid promotion and increasing favour, rejected with great disdain. He left Copenhagen April 24, 1715, his frigate then being attached to the fleet under Admiral Gabel, who despatched him for the purpose of reconnoitring the Swedish fleet, commanded by Admiral Wachtmeister, on the coast of Norway. Here, by his extraordinary seamanship, together with a boldness rarely surpassed, he was principally instrumental in destroying four ships of the line and three frigates, besides a large frigate which he captured, and in which, as a due reward for his eminent services, he was sent to Copenhagen as bearer of the glorious tidings. For this exploit he was raised to the rank of commodore, and a short time afterwards he was appointed to the command of a squadron destined to cruise in the Baltic for the purpose of intercepting transports with fresh supplies of troops for Charles XII., then in Pomerania.

On the 7th of August, 1716, off the island of Rügen, he came in sight of the Swedish fleet commanded by Wachtmeister. Charles XII. himself stood on an eminence on the island to see the victory of his flag, as to which there could scarcely be a doubt, as the Swedish fleet amounted to more than double the number of ships of Tordenskiold's squadron. The great conqueror however was to be disappointed. Much better acquainted with the bearings and the ground he was on, and much more skilful in seamanship, Tordenskiold, contrary to all reasonable expectations, soon gained the weather side of the enemy, and then kept up his fire with such precision and rapidity, that in one hour three of the Swedish ships of the line and two frigates had struck, and the loss of the enemy in killed and wounded, besides one vice-admiral, amounted to more than three times that of the Danes. A gold medal was struck in commemoration of this victory, which the king permitted him to wear suspended by the blue ribbon of the Order of the Elephant, a distinction only twice granted before.

In the battle of Dyneskiln, July 17, 1717, and in that of Stroemstaedt, he fought with the same gallantry and success. In December, 1717, the king raised him to noble rank by the name of Tordenskiold (shield against thunder). The immediate cause of this new honour is characteristic, and deserves mention. On a very cold day Tordenskiold went on shore with a party of officers to dine with the king. By a sudden pitch of the boat he lost a golden snuff-box, with the king's portrait set in diamonds, and presented to him by his majesty. He immediately exclaimed, 'Rather die than lose that which my sovereign has given me!' and before his friends could prevent it, he threw himself overboard, and dived several times after it, till he at last was taken up senseless.

On the 26th of July, 1717, he took Marstrand, one of the most important Swedish fortifications in the Kattegat. The peace of Fredriksborg having been signed (July 23, 1720), Tordenskiold had a great desire to visit foreign countries. King Frederick gave his consent very reluctantly. At Hamburg, where he was received with princely honours, his travelling companion, a wealthy young man from Copenhagen, lost large sums at play to a Swedish colonel, De Stahl; and after his ready cash was exhausted, gave drafts upon his father to the amount of 30,000 crowns. Tordenskiold, upon being informed of it, declared his intention to call the gambler to a strict account; but the colonel having left Hamburg, Tordenskiold went to Hanover to be presented to George II. There, the day after his arrival, he met Colonel Stahl at a dinner party with one of the ministers. He immediately expressed his indignation and reluctance to dine at the same table with him. A violent quarrel ensued, and a hostile meeting was appointed for the following day at a place some miles distant from the capital. Tordenskiold went without a second, and only armed with a light dress-sword. Colonel Stahl used a heavy sword, with which he shivered his adversary's blade at the first onset, and then ran him through the heart: he expired in a few minutes, recommending his soul to Heaven, and charging his faithful valet to take his body to Copenhagen, where it was deposited in a chapel of the navy church (Holmens Kirke): the king himself attended the funeral. The general impression at the time was that foul play had been practised by instigation from a higher quarter.

(*Peter Tordenskiolds Liv, og Levnet*, 3 vols. 4to., Kiöbenhavn, 1747; the same in German, Copenhagen, 1753; Peter Suhm's *Historie af Dannemark, Norge*, &c., 1 vol. 8vo., Kiöbenhavn, 1787; *Histoire de Dannemarc*, par M. P. H. Mallet, 9 vols. 8vo., Paris and Geneva, 1788.)

TORDESI'LLAS, a small town of the province of Valladolid in Spain, situated on the right bank of the Douro, five Spanish leagues south-west of Valladolid, in 41° 28′ N. lat. and 5° 2′ W. long. Tordesillas, which some Spanish authors suppose to have been called 'Turris Syllana,' or 'Turris Syllæ,' under the Romans, is now a wretched town, scarcely containing 4000 inhabitants, although in the palmy days of Spain, during the reign of Ferdinand and Isabella the Catholic, its population is said to have amounted to 50,000. The town is commanded by a fine castle, where the mother of Charles V., Joanna, took up her abode, and died in 1555. Tordesillas is the birthplace of the celebrated Alonso Fernandez de Avellanada, the continuator of 'Don Quixote.' Not far from Tordesillas is the town of Villalar, where the Comuneros under Padilla were defeated by the imperial troops in 1522. (Miñano, *Diccionario Geografico*, viii. 472.)

TORELLI, LAELIO, was born at Fano, on the 28th of October, 1489. His family was noble, and had settled in that town about the beginning of the fourteenth century. While yet a mere boy he was entrusted to the care of his maternal uncle, Jacopo Costanzi, a professor in the university of Ferrara, under whom he made a respectable progress in the Greek and Latin languages. He subsequently studied law in the university of Perugia, and obtained the degree of doctor in his twenty-second year.

From 1511 to 1531 Torelli remained in the civil service of the Roman government. Soon after taking his degree he was appointed podestà of Fossombrone, and in a short time chief-magistrate of his native town. Scanderbeg Comnena, who had lost his hereditary states by becoming a convert to the Romish faith, received from the pope by way of compensation the seignorage of Fano. By his insolent abuse of power he rendered himself odious to his new subjects, and was expelled by a conspiracy, of which Laelio Torelli was the chief. Clement VIII. was at first much irritated, regarding the rebellion as directed against the papal government; but Laelio, by explaining its real object, succeeded in pacifying him, and was soon after appointed governor of Benevento. This post he occupied for eighteen months, at the end of which, returning to Fano, he became involved in the contest between that town and the Malatesti family; and about the year 1527 or 1528, found it advisable to seek an asylum in Florence.

In 1531 he was appointed one of the five auditors of the Rota of Florence, and he continued from that time till his death in the service of the Medici family. During far the greater part of this time he was attached to Cosmo, the first grand-duke of Tuscany, who became duke of Florence six years after this first appointment of Torelli, and died only two years before him (in 1574). From being a member of the Rota, Torelli rose to be podestà of Florence; he was subsequently appointed chancellor by the grand-duke, and in 1546 his principal secretary. His official duties did not entirely withdraw him from literary pursuits. He was an active member of the Florentine Academy, and in 1557 was elected into its council. His reputation as a statesman and man of letters procured him the honour of being elected a senator: his name was inscribed in the register of the patricians of Florence in 1576. He died the same year, in the month of March, having survived all his children.

Torelli published, in 1545, three legal tracts, entitled 'Laelii Taurelli Jurisconsulti Fanensis, ad Gallum et Legem Velleam, ad Catonem et Paulum Enarrationes; ejusdem de Militiis ex casu, ad Ant. Augustinum epistola,' dedicated to his son Francesco. They were printed at Lyon; the Antonius Augustinus (bishop of Tarragona), to whom the third is addressed, printed it in 1544 as an appendix to his 'Emendationes;' and Zilettus included them in his great collection, 'Tractatus Tractatuum' (1633-1642). A Latin eulogium of Duke Alexander de Medici, delivered by Laelio in 1536, and a panegyric on Count Ugo, the founder of an abbey at Florence, in Italian, are said to have been printed. But the work which has preserved the name of Laelio Torelli is his edition of the Florentine manuscript of the Pandects. It was printed at Florence by Lorenzo Torrentino, printer to the grand-duke, in 1553. From the dedication to Cosmo I., which is written by Francesco Torelli, we learn that the preparation of the transcript and the supervision of the press had occupied all his own and his father's leisure hours for the ten preceding years. Francesco claims for his father the honour of projecting the edition, and gives Cosmo the credit of defraying the expense of the sumptuous publication. The orthography and all the little peculiarities of the MS. are said to have been strictly adhered to. The Greek passages were revised by Peter Victor. The translations of these passages are taken from Antonius Augustus, Haloander, and Hervagius. This edition is a fine specimen of typography, and worthy of the important monument it was the means of rendering more accessible to the public. The pope, the emperor, and the king of France gave the printer letters of protection against any piracy of the work for ten years, and Edward VI., the king of England, for seven. With regard to the Florentine (or Pisan) manuscript, the inquiries of Savigny, Blume, and others have established this to be the oldest copy of the entire Pandects of Justinian that exists. Leaving out of view the story of its discovery at Amalfi, the assertion of Odofredus that it was transmitted to Pisa by Justinian, and the statement of Bartolus that it was 'always' at Pisa (semper enim fuit totum volumen Pandectarum Pisis et adhuc est), establish for this MS. of the Pandects an antiquity beyond what can be claimed for any other. Borgo dal Borgo has produced evidence to the extraordinary care taken for its preservation by the government of Pisa; and the government of Florence has watched no less anxiously over its safety since it was transferred to that city in 1406, after the capture of Pisa by the Florentines under Gino Caponi. The Florentine MS. must always remain one of the most important authorities for the text of this portion of the Corpus Juris, and Torelli appears to have discharged the office of editor with a full sense of the importance of his task.

The contemporaries of Laelio Torelli are unanimous in their testimony to the integrity and disinterestedness of his character.

(Manni, *Vita di L. Torelli*; Savigny, *Geschichte des Römischen Rechts im Mittelalter*; Laelii Taurelli *Jurisconsulti Fanensis, ad Gallum et Legem Velleam, ad Catonem et Paulum Enarrationes; ejusdem de Militiis ex casu*, Lugduni, 1545; *Digestorum, seu Pandectarum Libri Quinquaginta ex Pandectis Florentinis repraesentati: Florentiae in officina Laurentii Torrentini Ducalis Typographi*, 1553.)

TORELLI, GIUSEPPE, an Italian mathematician, was born at Verona, in 1721. Having received the rudiments of education in that city, he was sent to the university of Padua, where he distinguished himself by his assiduity in cultivating both literature and science, and where he obtained a doctor's degree. Engaging in no profession, he prosecuted the study of the antient and modern languages, and at the same time he applied himself particularly to the writings of the Greek geometers. He is chiefly distinguished by his edition in Greek and Latin of all the works of Archimedes, in the preparation of which he was engaged during the greater part of his life, and for which his talents as a mathematician, as well as the extent of his classical attainments, particularly qualified him: he had not however the satisfaction of enjoying the fruits of his labours, for he died in 1781, almost at the moment of the completion of the work. The manuscript was sold after his death to the university of Oxford, and, under the superintendence of Dr. Abram Robertson, the work was published, in 1792, by the curators of the Clarendon Press.

This splendid edition contains the notes of the antient commentators, and the observations of Torelli himself on the tract 'De Conoidibus et Spheroidibus;' and to these are added the various readings which occur in the manuscript copies of Archimedes in Paris and Florence, together with a commentary by the Oxford editor on the tract relating to floating bodies.

TORENIA, a small genus of plants of the natural family of Scrophularineæ, found in India, the tropical parts of New Holland, and in South America. T. asiatica, a species found in almost every part of India, is described by Rheede as having the juice of its leaves employed as a cure for gonorrhœa on the coast of Malabar.

TOREUTIC. [Phidias; Sculpture.]

TORFAEUS, or TORMO'DUS, his assumed literary names after having been introduced to the learned world as a Latin author. His real Icelandic name is Thormod Thorveson. Little or nothing is known about his early life. He was born at Engoe, a small island on the southern coast of Iceland, of poor parents, who however were in sufficiently good circumstances to give him an outfit (for the institution, like all public schools in Iceland, was a free-school) for the Latin school at Skalholdt, where, according to Iceland custom, he became a good classical scholar; so much so, that upon his arrival in Copenhagen, his choice and fluent Latin surprised the professors there. In the year 1654 he was entered as a free student at the university of Copenhagen, where he remained till the year 1657. In the year 1659 he was captured and made prisoner by a Swedish privateer on his return from Christiansand in Norway. This circumstance appears to have given him some notoriety, for immediately after his release and return to Copenhagen, king Frederick III. appointed him interpreter of Icelandic manuscripts, and a short time afterwards sent him to Iceland for the purpose of collecting manuscripts, which, with the assistance of his warm friend and patron, Brynhjulf Swendson, bishop of Skalholdt, he accomplished so well, that the collection which he brought back, and which is still preserved in the Royal Library in Copenhagen, is considered the best in the world for antient Scandinavian history and literature. The king gave him, shortly after his return, as a reward for his zeal, and to enable him to pursue his studies, a small appointment at Stawanger in Norway. This office however he resigned in the year 1667, upon being appointed keeper of the king's collection of antiquities. He made soon afterwards another voyage to Iceland, for the purpose of taking possession of some little property, to which he had succeeded after the death of his father and of his elder brother; and after his return the same year, he went to Amsterdam for some literary purpose. During his voyage back he was shipwrecked at Skagen; and on his journey by land to Copenhagen, he was insulted and attacked in a small town in Sealand by one of his countrymen, whom, in defending himself, he accidentally killed. This circumstance caused great excitement. He surrendered himself immediately, was tried, and sentenced to death. However, by an appeal to a superior court, and an 'appellatio ad tronum,' or appeal to the throne, as it is termed in Danish jurisprudence, his sentence was commuted into a fine, which he paid, and was released; but as it was impossible for the king to retain a man in his service with a blemish on his reputation, he was dismissed, and lost his salary. He then retired to a small farm in Norway, the property of his wife, where he lived without any official employment till the year 1682, when Christian V., having succeeded to the Danish throne, recalled him, and appointed him royal historiographer, and an assessor in the consistory, or board of education, with a salary sufficient to enable him to live independently and to pursue his studies. This appointment he kept till his death. He commenced his most important work, the 'History of Norway,' and finished it as far as the Union of Calmar, when, unfortunately, ill health compelled him to surrender his favourite task to his friend Professor Reitzer. He was married twice: his first wife died in the year 1695: he married again in 1709; and in the year 1719 he died, very far advanced in years, without issue. His works, printed, as well as in MS., are very numerous, and exhibit deep knowledge and indefatigable research into antient Scandinavian history. The MSS. he left are preserved at the Royal Library in Copenhagen: as to his published works, it will be sufficient to mention the most important, which are:—'Historia Rerum Orcadensium, libri iii.,' fol., Hafniae, 1715; 'Series Dynastarum et Regum Daniae à Skialdo ad Gormum Grandovem,' 4to., Hafniae, 1712; 'Historia Rerum Norvegicarum ad Annum 1387,' 4 vols. fol., Hafniae, 1711. A very accurate account of his later works, together with a collection of private letters, which show at least that he wrote elegant Latin, is to be found in a work published by the celebrated Danish historian Peter Suhm, under the title 'In Effigiem Thormodi Torfaei, una cum Torfaeanis,' &c., 4to., Hafniae, 1777; Peter Suhm's 'Smaae Skrifter og Afhandlinger,' Kiöbenhavn, 1788; Eber's 'Bibliographisches Lexicon,' Leipzig, 1819; 'Allgemeines Historisches Lexicon,' Leipzig, 1747.

TORGAU is a strongly fortified town in the government of Merseburg, in the Prussian province of Saxony. It is situated in a low country, containing numerous meres and ponds, on the left bank of the Elbe, over which there is a bridge 860 feet long and 20 feet wide, half of stone and uncovered, and half of wood and covered. There are in Torgau four churches, in one of which is the tomb of Catherine Bora, the wife of Luther, and valuable paintings by Lucas Cranach; a gymnasium, and several schools; a district tribunal which has ten towns in its jurisdiction, and various public offices. The inhabitants, 7000 in number, besides the garrison of between 2000 and 3000 men, had formerly extensive manufactories of woollens, and breweries; at present they have still some manufactures of woollen cloths, stockings, linen, leather, and soap, and derive a principal part of their subsistence from shipbuilding, dyeing, and a considerable trade in corn, timber, and lime. The fortifications are now very strong, including the fort of Hartenfels standing on a rock, which was formerly detached, and used as a house of correction: in 1809 it was resolved to convert the town into a fortress, on which occasion 300 houses were pulled down. In the year 1760 a decisive victory was obtained by Frederick II. of Prussia over the Austrians in the vicinity of Torgau. In November and December, 1813, it was besieged by the Prussians, capitulated on the 26th of December, and was given up by the French garrison on the 10th of January, 1814.

It was at Torgau that Luther and his friends signed, in 1530, the Torgau Articles, which were the basis of the Augsburg Confession; and here too the Torgau book, which was directed against Crypto-Calvinism, was signed by above 8000 clergymen.

(Müller, *Lexicon;* Stein, *Lexicon;* Hassel; Cannabich.)

TORI'NO, the Intendenza or Province of, is bounded on the north by the province of Ivrea, west by the provinces of Susa and Pinerol, south by the provinces of Saluzzo and Alba, and east by those of Asti and Vercelli. The province of Turin forms part of Piedmont proper. It extends on both banks of the Po, and along the watercourses of the Dora Ripuaria, the Sangone, the lesser Stura, the Orco, and other streams which come from the Alps and flow into the Po. The valley of Lanzo, north-west of Turin, which is drained by the lesser Stura, and reaches to the foot of the lofty Mount Iseran, which divides it from Savoy, is one of the finest and most picturesque districts in Piedmont. It supplies Turin with cattle and the produce of the dairy. It has also mines of iron and other minerals.

The province of Turin contains 136 communes, 169 parishes, and 343,000 inhabitants. (Serristori, *Statistica.*) The principal towns, besides the capital, are:—1. Rivoli, west of Turin, on the high road to Susa, has 5300 inhabitants; manufactories of linen and woollens, and a king's palace. The country around is interspersed with country-houses. 2. Chieri (pronounced Ker in Piedmontese, Quiers in French), a well-built town of 12,000 inhabitants, situated on the hills of Monferrato, six miles east of Turin, has several churches and convents with good paintings, and some noblemen's palaces, and a very fruitful territory. It is one of the chief markets for silk in Piedmont. Chieri was a republic of some importance in the middle ages, which long maintained its independence, whilst Turin, Susa, and other towns of Piedmont acknowledged their feudal counts or lords. The French historical families of Broglie and Crillon are originally from Chieri, as well as the families of Belgiojoso and Balbi, which have remained in Italy. (Denina, *Quadro Istorico dell' Alta Italia.*) 3. Moncalieri, on the right bank of the Po, south of Turin, on the high road to Alessandria and Genoa, has a royal palace, and 7300 inhabitants. 4. Carignano, a town of 7000 inhabitants, in a fertile plain on the left bank of the Po, 11 miles south of Turin, on the high road to Nice. 5. Carmagnola, on the right bank of the Po, has 12,000 inhabitants, and is a great market for silk. 6. Chivasso, a town of 7000 inhabitants, on the left bank of the Po, near the confluence of the river Orco, 12 miles north-east of Turin, on the high road to Milan, in a plain abounding with corn and cattle. 7. Rivarolo, in the valley of the Orco, has 5000 inhabitants. 8. Poirino, on the road to Alessandria, has 5600 inhabitants. There are besides these, many towns of between 2000 and 3000 inhabitants in the neighbourhood of Turin, such as Pianezza, Caselle, Lanzo, Montanaro, Gassino, Viù, Vinovo, and others. The province of Turin is altogether one of the most fertile and thickly inhabited districts in Italy. (*Calendario Sardo;* Denina; Neigebaur.)

TORI'NO, TURI'N in French, the capital of Piedmont, and the residence of the king of the Sardinian States, is situated in 45° 5′ N. lat. and 7° 44′ E. long., on the left or western bank of the Po, which here runs in a northern direction, and at the confluence of the Dora Ripuaria, which flows from the valley of Susa. It lies in a wide and fertile valley, between the lower offsets of the Cottian Alps on the west, and the hills of Monferrato, which rise immediately above the right or eastern bank of the Po. The valley opens to the north-east into the wide plain of Lombardy.

Turin is one of the most regularly-built towns in Europe; most of the streets being in straight lines and intersecting each other at right angles, and the squares being also of a regular form. The streets are kept cleaner than in most other Italian cities, being washed during the night by water drawn from the Dora. The buildings, though massive and lofty, are, generally speaking, plain, chiefly built of brick, and their appearance is uniform and monotonous. The town is about one mile and a quarter in length and little more than half a mile in its greatest breadth; it was formerly surrounded by ramparts, which have been razed of late years, and additional buildings and promenades have been constructed in their place. The citadel, which is regularly constructed, and one of the strongest in Italy, lies outside of the town to the westward. The principal streets of Turin are those leading to the four entrances of the town, which are—Porta del Po, on the road to Alessandria and Genoa; Porta Susina, on the western or Mont Cenis road; Porta Nova, on the southern road to Saluzzo and Nice; and Porta Vittoria, leading to Ivrea, Vercelli, Novara, and the other northern provinces. Several of the principal streets and squares are lined with arcades, which are much frequented by loungers.

The principal square is the Piazza Castello, in the centre of the town, so called from an old castle or palace which stands in the middle of it, and which was formerly the residence of the dukes of Savoy. It has a handsome façade, ornamented with sculptures. The northern side of the square is formed by the modern royal palace, a vast structure, with gardens at the back of it: the apartments are handsome, and contain a rich collection of Flemish and Italian paintings and a library. Adjoining to the palace is the cathedral of S. Giovanni Battista, with the annexed handsome rotunda chapel, Del Sudario, cased with black marble, and adorned with gilt bronzes. On the eastern side of the square is the great theatre, one of the largest and finest in Italy, constructed by the architect Alfieri. Another remarkable building of Turin is—the University, built by king Victor Amadeus at the beginning of the eighteenth century. It is a fine building, with a spacious court, surrounded by arcades, which are lined with antient bassi-rilievi, and inscriptions fixed in the walls, many of which are valuable, and have been illustrated by Maffei and others. The library of the university contains above 112,000 volumes and about 2000 MSS., among which are the palimpsests, from the monastery of Bobbio, containing fragments of Cicero's orations 'Pro Scauro' and others, which have been deciphered and published by Professor Peyron. The Gallery of Antient Statues contains some remarkable objects, such as a Minerva, in bronze, discovered in 1829 near Voghera; a sleeping Cupid, a bust of the emperor Julian, and the Isiac Table. The Cabinet of Medals, one of the richest in Europe, contains 30.000 pieces. The Egyptian Museum, which is in the building of the Royal Academy of Sciences, consists chiefly of the collection made by M. Drovetti, long time consul in Egypt, which was purchased by King Charles Felix, and is one of the richest in Europe. It contains among others the colossal statue of Osymandyas, 15 feet high; those of Thothmes II. and of Amunoph II.; and that of Remeses II., or Sesostris, which is considered one of the handsomest specimens of Egyptian sculpture; a collection of Egyptian paintings on stone, a quantity of utensils, articles of dress and ornaments, numerous mummies, and a vast collection of papyri and MSS. on linen, found in the catacombs of Thebes: among others, a funeral ritual, 60 feet in length; and the fragments of a chronological table of the dynasties of the kings of Egypt previous to the eighteenth dynasty.

The university consists of five faculties,—divinity, law, medicine, surgery, and arts. Among the contemporary professors, Boucheron, professor of Greek and Latin; Peyron, of Hebrew and the Oriental languages; Plana, of mathematics; Giobert, of chemistry; are well-known names. There are also belonging to the university a museum of natural history, a museum of anatomy, a chemical laboratory and hydraulic apparatus, and lastly, a rich botanical garden at the Valentino, outside of the town, near the banks of the Po. About 2000 students attend the various courses. Altogether the University of Turin ranks as one of the first in Italy. The Royal Academy of Sciences, begun as a private society in 1759, and instituted as an academy in 1783, consists of forty members, besides non-resident and corresponding members: it is divided into two classes, mathematical and physical sciences, and moral, historical, and philological sciences. Lagrange, Bertrandi, Cardinal Gerdil, Count Morozzo, the chemist Moion, Count Balbo, the Orientalist Derossi, Count Xavier Maistre. the antiquarian Fea, Manno, the historian of Sardinia, Cibrario, the Chevalier della Marmora, and other well-known names, are or have been members of this society. The Academy has published about 30 volumes of Memoirs.

Turin has also an academy of the fine arts, a philharmonic academy, and an agricultural society, 'Reale Società Agraria,' and a military college, 'Regia Militare Accademia,' newly organized, under the direction of the Chevalier Saluzzo. There are communal schools, divided into classes, in each district of the town; and also schools for drawing applied to the mechanical arts; and schools for the deaf and dumb and the blind.

The charitable institutions of Turin are:—1, the Great Hospital of S. Giovanni Battista, for the infirm; 2, the Spedale di Carità, an asylum for destitute children and aged persons; 3, Spedale della Maternità, or lying-in hospital; 4, the Reale Albergo di Virtù, a house of industry for young men, who are taught various trades; 5, the house for the insane; 6, Opera di S. Luigi Gonzaga, a charitable institution, which administers out-door relief to infirm and other disabled poor persons, and has besides an hospital for persons afflicted with incurable chronic diseases, which is considered as a model of cleanliness and proper arrangement; 7, Monte di Pietà, which lends money to the poor without interest upon pledge. There are two penitentiaries, one for men and the other for women.

Turin is an archbishop's see, whose province extends over the sees of Alba, Acqui, Asti, Cuneo, Fossano, Mondovì, Ivrea, Pinerolo, Saluzzo, and Susa. The metropolitan diocese contains the chapters of Turin, Moncalieri, Rivoli, Chieri, Carmagnola, Sandalmazzo, Giaveno, and Savigliano; and the clerical seminaries or colleges of Turin, Giaveno, Brà, and Chieri. The archbishop has a curia, or court for ecclesiastical suits, consisting of a vicar-general and a pro-vicar, a chancellor, pro-chancellor and notary, a fiscal advocate, a counsel for the poor, besides secretaries.

Turin contains a great number of churches, few of which are remarkable for their external architecture. Those worthy of notice are:—S. Filippo Neri, by the architect Giuvara, with several good paintings; the Consolata; the Corpus Domini, which is very richly decorated; Santa Teresa, Santa Cristina, La Trinità, and S. Carlo Borromeo. There are convents of Franciscans, Dominicans, Cistercians, Carmelites, Barnabites, Servites, Somaschi, Jesuits, Fathers of the Oratory, Brothers of the Christian Schools, missionaries of the Congregation of St. Vincent de Paule, besides several nunneries. In the suburb, on the right bank of the Po, facing the bridge, is the fine new church 'Della Gran Madre di Dio,' raised by the municipality of Turin, in memory of the restoration of the dynasty of Savoy, in 1814. It is an imitation of the Pantheon of Rome: it is cased with marble, and adorned with marble pillars. Higher up on the hill is the Capuchin church and convent 'Del Monte,' beautifully situated, like most Capuchin convents are, and enjoying a splendid view of the plain of Turin, the town, and the river, and of the crescent of the snow-capped Alps, from the lofty pyramid of Mount Viso on the west, to the picturesque group of Mount Rosa on the north-east. On a higher hill on the same side of the Po, but farther north, about 2000 feet above the sea, and five miles from Turin, is the Royal Basilica of La Superga (super terga montium), the St. Denis of Piedmont, containing the tombs of the princes of the house of Savoy. It was built from the design of Giuvara by king Victor Amadeus, in memory of the raising of the siege of Turin by the French, in September, 1706. It is a handsome structure; its lofty dome is seen at a great distance, and is the first object that strikes the traveller on approaching Turin. A congregation of twelve secular priests is attached to the service of the church. Every year, on the 8th of September, a great festival takes place at Superga: high mass is performed, at which the court generally attends, and multitudes from Turin and the country around repair to the spot. After church service, the people spread about in the fields to eat, stroll, and dance the monferina, the lively national country-dance.

The city of Turin has a municipal body, which enjoys considerable privileges, and directs the internal or civic administration of the town; it consists of a Corpo Decurionale, or council of about sixty members; two syndics; a vicario, who is at the head of the police department; a treasurer, and numerous accountants, commissaries, inspectors, and secretaries. The municipality of Turin has considerable revenues; it levies the 'octroi,' or duty at the gates upon provisions, and a tax upon mills; it administers the municipal domains, and the city of Turin is styled in public documents 'l'illustrissima città di Torino, Contessa di Grugliasco, Signora di Beinasco.' There is a board of commissioners, styled 'Consiglio degli Edili,' which superintends all new buildings and streets, and the repairs, embellishments, and additions which are made in the town or suburbs. Turin has two insurance companies and an organized body of firemen.

The manufactories of Turin are of some importance; they consist of woollens, silks, hosiery, leather, paper, chinaware, carriages, a manufactory of arms, and a royal manufactory of tapestry or Gobelins.

Turin has several theatres, besides the royal theatre already mentioned: the theatre of Carignano, for the opera; the theatre d'Angennes, for dramatic pieces unaccompanied by music; and the New Theatre. Piedmont has produced some of the best modern Italian dramatists—Alfieri, Federici, Olivieri, Nota, Pellico, and Marchisio. The nobility have a casino, or assembly-room. The coffee-houses of Turin are numerous, but, generally speaking, not so roomy or elegant as those of Milan or Naples. Besides the buildings already mentioned, the palace of Carignano, by the architect Guarini, is large, but in bad taste; the palace Birago di Borgaro, after the design of Giuvara, is in a better style; and that of the marquis de Prié has a gallery of paintings. The royal country-house called 'Vigna della Regina' is a pretty villa finely situated on the hill on the right bank of the Po. The royal hunting palace and park of Stupinigi, four miles from Turin, are very fine; the palace was begun by Giuvara, and enlarged by Alfieri, the architect. At La Veneria, once a royal residence, about eight miles north of Turin, is the royal riding-school, stud, and veterinary college. The king of Sardinia has also palaces at Moncalieri, on the south side of the Po, about five miles from Turin, and at Rivoli, ten miles from the capital, on the high road to Susa and Mont Cenis; besides the royal palaces of Chambery and Genoa, which he uses when he visits those parts of his dominions.

The population of the town of Turin, which at the beginning of the eighteenth century amounted to about 42,000, had risen to 76,000 in 1796, just before the French revolutionary invasion, after which it fell to about 65,000, at which amount it remained till the restoration. In 1816 it had risen again to 73,500, not including the suburbs. By the census of 1830, including the suburbs, it amounted to 116,000; and by that of 1833, to 119,909, out of which number there were 888 priests, 453 monks, and 227 nuns. (Serristori, *Statistica dell' Italia*.)

Diligences after the French fashion set off from Turin three times a week for Milan, Genoa, and France, besides numerous post-coaches, called 'velociferi,' which run between the capital and most provincial towns of the Sardinian territories. Living at Turin is reasonable, provisions of every sort are good and abundant, and the cooking is a medium between French and Italian cookery. The manners, habits, and dress of the people partake likewise of French and Italian. The national character is sociable, steady, and intelligent. There is a tone of formality and etiquette maintained by the court, which communicates itself to the upper ranks of society. The common language of conversation among the natives is the Piedmontese dialect; but Italian is the written and official language, and educated people speak both Italian and French. The climate of Turin is colder in winter than that of Genoa or Rome, but is much milder than that of Savoy or Switzerland. Upon the whole, Turin is a pleasant residence for a person of quiet habits; but being on the threshold of Italy, it is less noticed than it deserves by travellers, who hurry on to the south, to Genoa, Florence, Rome, and Naples, cities more thoroughly Italian than Turin.

The antient Taurini were a tribe of the Ligures, who inhabited the country between the Po and the Cottian Alps. They are the first people whom Hannibal met after descending the Alps: they appear to have resisted him, and he took their town by force previous to advancing to the Ticinus. (Livy, xxi. 39.) They and the other Ligurians north of the Apennines were subdued by the Romans about 166 B.C., but their neighbours the mountaineers of the Cottian Alps were not reduced till the time of Augustus. Augustus sent a Roman colony to the town of the Taurini, which then took the name of Augusta Taurinorum. Under the Longobards Turin was the head town of a duchy: under the Carlovingians it was a county of considerable extent and importance, and a fief of the kingdom of Italy. In the tenth century we find Odelric Manfredi, count of Turin, styled marquis of Italy, who was the father of the marchioness Adelaide. [AMADEUS I.] Adelaide married Oddo, count of Maurienne, and from this marriage the house of Savoy derives its origin. During the war of the investitures between the popes and the emperors of Germany, most of the large towns in north Italy established their independence as municipal communities, in which the respective bishops had however a great influence; and Turin was among the number, but in the early part of the twelfth century the emperor Lotharius reduced it again to subjection; and although he respected its municipal liberties, he appointed again a count for its political governor. We find Amadeus III. of Savoy, count of Maurienne, about the middle of the twelfth century dating his diplomas from the town of Turin, of which he is styled marquis. The emperor Frederic I. made over, in 1159, to Charles, bishop of Turin, all the rights of the empire over that town, namely, the 'districtum' or jurisdiction, the 'fiscum,' or fiscal duties, and 'teloneum,' or customs, the walls of the city and all civil rights within and without for ten miles around. (Cibrario, *Storia della Monarchia di Savoia*, and the authorities therein quoted.) The bishops and commune of Turin remained for about a century after independent of, often at variance with, the counts of Savoy, who at last asserted again their suzerainty over the town and the right of appointing its chief magistrate. From that time the history of Turin is merged into that of the dynasty of Savoy, whose permanent residence it became ultimately. [SARDINIAN STATES.]

Tesauro has written 'Istoria della Città di Torino,' 1679, with a Continuation by F. M. Ferrero, 1712; Rivautella and Ricolvi have published 'Marmora Taurinensia Illustrata,' 2 vols. 4to., 1743-47; Milanesio, 'Cenni Storici sulla Città e Cittadella di Torino,' 1826; Paroletti, 'Turin et ses Curiosités,' 1819, a guide-book; Borson, 'Catalogue raisonné du Musée d'Histoire Naturelle de l'Académie de Turin,' 1811; Peyron, 'Papyri Græci R. Taurinensis Musei Ægyptii editi atque illustrati,' 1826. See also Millin, *Voyages en Savoie et en Piémont*, 1816; and Valéry, *Voyages Littéraires en Italie*.

TORI'NUS, ALBA'NUS, the Latinized name of Alban Thorer, a Swiss physician, who was born in 1489, at Winterthur, in the canton of Zürich. He studied polite literature at Basle with zeal and assiduity, and, after teaching rhetoric for some years, he at last determined on taking the degree of Doctor of Medicine at Montpellier. Upon his return to Basle, in 1537, he was appointed professor of practical medicine, and soon acquired an extensive practice. He died February 23, 1550, at the age of sixty-one. Like several of his contemporaries, he employed himself in translating the works of the Greek medical writers into Latin, of which he published the following: 'Polybi Opuscula aliquot nunc primum e Graeco in Latinum conversa, nempe de Tuenda Valetudine, sive de Ratione Victus Sanorum lib. i., De Seminis Humani Natura lib. i., de Morbis, sive Affectibus Corporis libri ii.,' Basil., 1544, 4to. Alexander Trallianus, Lat., Basil., 1533, fol. The first Latin translation of Paulus Ægineta, Basil., 1532, fol., which was afterwards improved and several times reprinted. This translation was severely criticised by Winther of Andernach (*Guinterus Andernacus*), which drew from Thorer a very angry and somewhat abusive answer entitled 'Epistola Apologetica, quâ Calomnias Impudentissimas refellit,' Basil., 1539, 8vo. The first Latin translation of two works of Theophilus Protospatharius, with the title 'Philareti de Pulsuum Scientia Libellus, item Theophili de Exacta Retrimentorum Vesicae Cognitione Commentariolus,' &c., Basil., 1553, 8vo. In his translation of Theophilus 'De Urinis,' he is charged by Guidot (Not. in Theoph. *De Urin.*, p. 234; et *Alloq. ad Lect.*) with having altogether omitted the pious epilogue to the work, and with having altered two other passages (in the Preface, and in cap. 8) so as to destroy the acknowledgment of our Lord's Divinity contained in them. Fabricius mentions also (*Biblioth. Graeca*, vol. xiii., p. 44, ed. Vet.) a translation of Theophilus's 'Commentary on the Aphorisms of Hippocrates,' but this is probably a mistake. (See Fabric., *Biblioth. Graeca*, vol. xii., p. 649, ed. Vet.; Choulant, *Handbuch der Bücherkunde für die Aeltere Medicin.*) He also retouched the old Latin translation of Yahia Ibn Serapion Ben Ibrahim [SERAPION], and published it with the title 'Jani Damasceni Therapeuticae Methodi libri vii., partim Albano Torino, partim Gerardo Cremonensi Metaphraste,' Basil., 1543, fol. He published a Greek edition, in one volume, of several of Hippocrates's works, viz. 'Prognost.,' 'De Nat. Hom.,' 'De Loc. in Hom.,' 'Jusjur,' Basil., 1536, 8vo., and prefixed a Life of the author. He inserted a Latin translation of the Letter of Diocles Carystius to King Antiochus, 'De Secunda Valetudine Tuenda,' in the second edition of his translation of Alexander Trallianus, Basil., 1541, fol. He also edited a collection of medical works with the following title: 'De Re Medica huic Volumini insunt, Sorani Ephesii Peripatetici in Artem Medendi Isagoge hactenus non visa. Oribasii Sardiani Fragmentum de Victus Ratione, quolibet Anni Tempore Utili, antea nunquam editum. C. Plinii Secundi de Re Medica libri v. accuratius Recogniti, et Nothis ac Pseudepigraphis Semotis, ab Innumeris Mendarum Millibus Fide Vetustissimi Codicis Repurgati. Lc. Apuleji Madaurensis, Philosophi Platonici, de Herbarum Virtutibus Historia. Accessit his Libellus Utilissimus de Betonica, quem quidam Autonio Musae, nonnulli Lc. Apulejo adscribendum autumant, nuper Excusus,' Basil., 1525, fol. Besides these medical works he edited also Apicius, 'De Re Culinaria,' Basil., 1541, 4to.; S. Epiphanius, 'De Prophetarum Vitis,' Basil., 1529, 4to.; Agapeti 'Scheda Regia,' Lat., Basil., 1541, 8vo., at the end of Onosandri 'Strategicus;' and Emmanuel Chrysolorae, 'Epitome Grammatices Graecae.' (See Fabric., *Bibliotheca Graeca*, vol. xiii., p. 44, ed. vet.; *Biogr. Méd.;* Choulant, *Handb. der Bücherkunde für die Aeltere Medicin.*)

TORMENTIL, *Tormentilla officinalis* (Smith), *erecta* (Linn.), a small perennial plant, growing in the whole of Europe and the north of Asia, in forests, bogs, and heaths. Linnæus constituted this genus, but it is sometimes regarded as a species of the genus Potentilla. The root, or rather the rhizoma, is officinal. As the plant flowers in June and July, the best time to collect the rhizomata is in April and May. Those gathered in autumn, while they remain moist, are phosphorescent. The roots of the Tormentilla (Potentilla) reptans (Linn.), of the Potentilla Commarum, those of the common strawberry, and also of the Polygonum Bistorta, are frequently confounded with those of the true tormentil—errors of no great importance as far as their medical employment is concerned, as they possess properties similar in kind, but inferior in degree. In Italy the root of the geranium striatum is substituted for it.

The rhizomata of the genuine plant are large in proportion to the branches they bear. They lie obliquely in the earth; old ones are knotty or resemble knobs, from 1½ to 2 inches thick; younger ones are cylindrical, irregularly branched, the branches 1 to 2 inches long, and from one-fourth to one-half inch thick, curved and twisted. The colour externally is a rusty or reddish brown; if very old mixed with black. The epidermis and liber are very thin, but firm. The central part presents several, at least two, concentric circles; the texture is close and firm, more of a horny than fibrous texture, greatly resembling rhubarb. The colour of the interior, when fresh, is a rose-red or fleshy colour; but when dried, it inclines more to a reddish or brownish yellow; in very old specimens it becomes white. The fracture is uneven. It can be easily powdered. The powder is of a bright brownish-red. The rose-odour of the fresh root is utterly lost by drying. Taste purely and strongly astringent. Specimens which are dark externally, and woody and white within, are to be rejected.

Meissner very carefully analyzed it, and found it to consist, in the hundred parts, of—volatile oil, a trace; myricin 0·20; resin, 0·42; cerin, 0·51; tannin, 17·4; colouring matter, 18·05; ditto altered (oxydized?), 2·58; gummy extractive, 4·32; gum (pectin?), 28·20; extractive, 7·70; woody fibre, 15·0; water, 6·45.

Starch, though not found by Meissner, exists in it, as the tincture of iodine tinges the root a blackish-blue. No gallic acid is said to exist in it; while its presence is asserted by some, it is maintained to be ellagic acid by others. The colouring-matter resembles that found in the cinchona barks; it also has some resemblance to indigo. Water distilled from the fresh root has an agreeable rose-like odour. This plant contains more tannin than any other except catechu and galls. An intimate relation subsists between the tannin and extractive and catechu. An infusion strikes a blackish-green (forming a tannate of iron with sesqui-chloride of iron; on which account an ink has been recommended to be made with it and sulphate of iron but where galls are to be had, this is not advisable.

Tormentil is the most powerful of our indigenous astringents, and more easily assimilated than oak-bark or galls. Though improper in active hæmorrhages, in passive discharges it is very useful, and may be given with aromatics or opiates, or chalk, as in the compound powder of chalk. Infusion made with cold water is preferable to the decoction. The extract made in the common way soon spoils. But valuable as this substance is in medicine, it is of still greater utility in the arts and in agriculture. It may be most beneficially employed to tan leather, both where the oak grows and where it is absent, since one pound and a half of powdered tormentil is equal in strength to seven pounds of tan. It is used in Lapland and the Orkney Isles, both to tan and to dye leather, and in the latter parts to dye worsted yarn. By long boiling the tannin is converted into gum, and in times of scarcity the poor may collect and obtain much nourishment from the root. But the great service this plant renders in husbandry is its chief merit. Where it grows abundantly in wet pastures, the rot in the sheep is unknown. It should therefore be extensively introduced into the irrigated meadows as a preventive of that destructive disease. Where the heather has been burned on the Highland hills, this plant springs up spontaneously with the tender grass. [ANTHELMINTICS.]

TORMENTILLA (from *tormentum*), a genus of plants belonging to the natural order Rosaceæ. This genus possesses an 8-parted calyx, of which four parts are external, and apparently accessory; the petals are 4, and inversely heart-shaped; the stamens are 16, and not half so long as the corolla; the styles are lateral and deciduous; the carpels are seated on a small hairy receptacle. The species are herbaceous plants with dissected and axillary and terminal flowers. The genus as thus constituted is well marked, although many authors refer it to Potentilla. Of the three species of Tormentilla, two are natives of Britain and Europe generally, and one of North America.

T. erecta, Upright Tormentil, has an ascending, branched dichotomous stem; ternate leaves, with those on the stem sessile; the leaflets are oblong, acute, and deeply cut; the stipules are large and also cut; the pedicels are solitary, in the bifurcations of the stem; the petals are obcordate, and of a yellow colour. It is abundant in barren pastures, road-sides, and bushy places in Great Britain and other countries of Europe. It has been occasionally found with five petals, and also with double flowers.

T. reptans, Creeping Tormentil, has procumbent, slightly branched stems; leaves divided into from three to five leaflets, which are deeply toothed, and hairy, as well as the petioles; the stipules are lanceolate and entire. It is a native of Europe, in much the same situations as the last. It is not so common in Britain as the last, but has been recorded as growing in many localities in Yorkshire, Essex, Norfolk, and Oxfordshire.

T. humifusa, Trailing Tormentil, is a native of North America. It has short filiform procumbent stems bearing the flowers; the leaflets are five, deeply toothed, and covered beneath with a white tomentum. [TORMENTIL.]

TORNADO, a whirlwind (from *tornar*, Spanish, 'to turn'), a sudden and violent storm of wind, accompanied by thunder, lightning, and heavy torrents of rain: it frequently occurs in the West Indies, on the western coast of Africa, and in the Indian Ocean, particularly about the time of the equinoxes, or, in the latter region of the earth, at the changes of the monsoons. The storm continues in one place for a few hours, during which time the wind rapidly changes its direction; and it is described as blowing at once, or in succession, from all the different points of the compass. Tornado is however a general term, and, besides a whirlwind, it is employed to designate what is called a typhoon or hurricane.

It has been supposed that the electric fluid, when collected in vast quantities in the atmosphere between the tropics, occasionally creates an extensive and partial rarefaction; the ambient air then rushes towards the region where this rarefaction has taken place, and the particles in their rectilineal course, being struck obliquely by currents flowing in directions which are determined by the ranges of mountains or the line of the sea-coast, acquire, by the laws of dynamics, circular or spiral motions. Thus there is formed a vortex by which terrestrial bodies within its influence are violently displaced, or the ocean is strongly agitated: on land, forests, plantations, and buildings are destroyed; and at sea, ships are engulfed or driven on shore: the effects are of course the greatest near the circumference of the vortex, and the space within which they are felt varies in extent; sometimes the diameter of the area is several miles, and at other times it does not exceed one hundred yards.

From accounts of the tornados, the typhoons, or hurricanes which occur on the coast of Africa, it appears that there the approach of the storm is foreboded in the morning by the appearance, over the land, of dark clouds which move towards the sea, while a gentle breeze is blowing towards the shore: soon afterwards the rain comes down in torrents, and the lightning darting from the clouds resembles showers of electric matter. While the tornado is passing over a ship, which may be four or five hours from the first appearance of the clouds, the flashes cease, but the rain continues, and a loud crackling noise, occasioned by the electric fluid descending along the masts, is distinctly heard among the rigging. After the squall has passed beyond the ship, the lightnings again appear to descend in sheets as they did on its approach.

A less extensive whirlwind is frequently preceded by a remarkable tranquillity of the atmosphere and a sultry heat; when suddenly, within a circle of one or two hundred yards only in diameter, a revolving motion of the air commences, and is accompanied by thunder and rain: the velocity of the rotation gradually increases, and at length its violence is such as to tear up trees and destroy buildings which may be within the vortex. The whirlwind does not continue longer than half an hour, but in that short time the damage is immense, and the loss of life is frequently considerable.

Dr. Franklin observed that great storms have a progressive movement on the surface of the earth, and he found that one which occurred in North America in 1740 advanced at the rate of about one hundred miles in an hour towards the north-east; but Colonel Capper, of the East India Company's service, who during twenty years had studied the phenomena of the atmosphere about Madras, first suggested the idea that all storms are tornados or whirlwinds of great extent, and showed that it might be possible to ascertain the place of a ship in a vortex from the degree of rapidity with which the wind changes its direction. Mr. Redfield, of New York, apparently without any knowledge of Colonel Capper's observations, discovered subsequently that, while on the coasts of North America hurricanes were blowing from the north-east, storms were raging in the Atlantic on the same parallel of latitude with the wind at south-west; and his inference is that a revolving tempest takes place at the same time over a considerable portion of the earth's surface.

This subject has recently been particularly studied by Lieut.-Col. Reid of the Royal Engineers, who has ascertained that all great storms have both progressive and revolving motions. Having obtained access to a number of ships' log-books, he compared the observations made by himself in the West Indies with such as had at the same times been made in the open seas, and he traced the courses of many storms both in the northern and southern hemispheres. This officer found, as had been before remarked by Mr. Redfield, that in the North Atlantic Ocean the direction of the air in a vortex is from the north circularly to the west; from thence to the south, and round by the east towards the north: and he discovered that in the southern hemisphere the order of the motion is contrary to that which has been just mentioned, being from the north round by the east, the south and the west, and returning to the north. He found also that the storms in each hemisphere revolve invariably in the same direction within a circular space whose diameter is sometimes not less than one thousand miles; and that occasionally, in advancing towards either pole, several different vortices closely follow each other: when this happens in the northern hemisphere for example, since in the southern part of each the wind is blowing from the west, and in the northern part from the east, it follows that the northern part of each vortex, on arriving at the spot which the vortex immediately preceding it had quitted, brings with it a wind blowing in a direction exactly contrary to that which had just before been felt.

Lieut.-Col. Reid has ascertained from two instances, of which alone he could obtain well-authenticated accounts, that in the opposite hemispheres of the earth the cones of water-spouts revolve in contrary directions; and it is remarkable that these directions are contrary to those of the great storms. Some connection is supposed to exist between the intensity of storms and that of terrestrial magnetism: the same officer remarks that no violent squalls are felt about St. Helena, where the magnetic intensity is the lowest, and that they occur with great violence in the West Indies and the Sea of China, in which regions the terrestrial meridians pass through the magnetic poles of North America and Siberia. It ought to be observed, however, that on the southern coast of Africa and in the Indian Ocean, where the magnetic intensity is low, storms rage with the greatest fury.

TORNEA. [FINLAND.]

TORNEA-ELF. [BOTHNIA.]

TO'RO, the capital of a province of Spain, formerly part of Zamora, but now a separate province, is supposed to be the Sarabris of Ptolemy. It is a large town, situated on the right bank of the Douro, on a gentle eminence which commands a view of an extensive plain, formerly called Campi Gothici, now Tierra de Campos: in 41° 45′ N. lat. and 5° 37′ W. long. It is the see of a bishop, suffragan of Zamora, one of the most antient in the peninsula. The collegiate church is a handsome Gothic building, the erection of which is ascribed to Alfonso VIII. of Leon. There are also the remains of an antient castle, said to have been built by the Infante Don Garcia, forming a square of 143 feet, with a round tower at each angle. The bridge on the Douro, entirely built of freestone, and resting on twenty-two arches, is a remarkable piece of architecture. Near Toro was fought, in 1476, a battle, where the Portuguese under Alfonso V., surnamed 'O Africano' (the African), were defeated by the Castilians. The population of Toro is about 10,000. (Miñano, *Diccionario Geografico de España*, viii. 480.)

TORONTO, formerly *York*, and lately the capital of the province of Upper Canada, in North America, is situated on the north shore of Lake Ontario, about 40 miles from the west end of Burlington Bay, in 43° 35′ N. lat. and 79° 20′ W. long. The town was founded in 1794 by Governor Simcoe. The French had previously a small palisadoed fort, a little to the west, which was called Fort Tarento or Torento. With the exception of this fort and two or three wigwams, the dwellings of a few Indians, the site of Toronto, when surveyed by direction of Governor Simcoe in 1793, was uninhabited, and the country was almost entirely covered with forest to the water's edge. The district, as it was gradually cleared by the British, was called Toronto, after Fort

Tarento; but the name given by Governor Simcoe to the town, which he laid out on a regular plan, was *York*, which name it retained till 1834, when Sir John Colborne raised it to the rank of a city, and changed the name to that of the district, Toronto.

The situation of Toronto is low and swampy, the ground rising gradually into the back country, which is covered with forest. The site seems to have been chosen chiefly on account of the spacious and beautiful harbour, or rather bay, which is protected and nearly enclosed by a long horn of sand sweeping round in a sickle shape, and leaving only a narrow entrance, which now forms the mouth of the harbour. The wharfs and piers however are narrow, inconvenient, and ill-lighted, and, as passengers are often landed and embarked at night, they are also dangerous.

The city consists of six main streets, about two miles long, and parallel to the shore of the lake, crossed at right angles by other streets which run inland about a mile. Most of the houses are still of wood, but as frequent fires destroy them, they are replaced by others of brick, stone being scarce, and the subsoil of the whole district a good clay. The principal street of the six long ones is called King Street; it begins to have a handsome appearance; it has many good brick houses, several of the shops having large plate-glass windows; it has side pavements of flags, and a large sewer under it. The general appearance of the city however is somewhat mean, and there are no public buildings worthy of notice for their architecture. The principal structures are the Parliament Buildings, the Bank of Upper Canada, the City Hall and Market-house, the Upper Canada College, the Lawyers' Halls, and the English, Roman Catholic, Scotch, and Methodist churches and chapels. A new court-house and gaol are probably now completed, as well as new barracks at some distance from the town. Building-ground in the principal streets is excessively dear, and house-rent is also expensive; but provisions are abundant, and at moderate prices; and wines, fruits, and other luxuries, not dear. The fuel is chiefly wood, and is mostly burned in stoves, though coals from the state of Ohio are brought by the Welland Canal, and sold at about 1*s.* 6*d.* a bushel. The water of the wells is brackish, the strata at forty feet deep being apparently saliferous rock.

Toronto has a Court of Chancery with a vice-chancellor, and a Court of Queen's Bench with a chief justice and four puisne judges; it has also a district court, in which minor offences are tried, a court of requests, a mayor's court, and a police court.

Toronto returns two representatives to the Legislative Assembly of the Province of Canada. For municipal government the city is divided into five wards, each of which returns annually two aldermen and two common-councilmen, out of whom a mayor is chosen annually.

Besides the established Church of England, which has its Bishop of Toronto, there are Roman Catholics, Wesleyan Methodists, Baptists, members of the Church of Scotland, and many other sects.

There is a House of Industry at Toronto, supported by voluntary contributions, in which, in 1841, there were between 70 and 80 inmates, and which gave relief to about 250 out-door pensioners. There is also an hospital; and there is a savings' bank, in which the amount of deposit by each person is limited to 50*l.* currency.

Of establishments for education, the chief is the College of Upper Canada, with a principal, five masters, and five teachers; the next in importance is the National School of Upper Canada, on the system of Bell and Lancaster; and there is a Board of Education for the supervision of the common schools.

There is a mechanics' institute, a commercial news-room, and a literary club, the last being under the patronage of the vice-chancellor, but no other literary societies of any importance. There is no regular theatre. There are seven or eight newspapers published in the city, one of which belongs to the Wesleyan Methodists.

The population of Toronto has advanced at the following rate:—in 1817 it was 1200, in 1826 it was 1677, in 1836 it was 9652, in 1837 it was 11,500, in 1839 it was 15,000, and may now (Oct., 1842) probably amount to 18,000.

Toronto is about 560 miles from Quebec, 390 from Montreal, 180 from Kingston, 130 from London in West Canada, and 75 from Niagara, travelling distances. Steam-vessels sail regularly from Kingston to Toronto, and thence to Hamilton, about forty miles farther to the west, at the head of Burlington Bay.

When the act of parliament (3 & 4 Vict., c. 35) which united the two provinces of Upper Canada and Lower Canada into one Province of Canada was carried into effect, on the 23rd of July, 1841, Toronto ceased to be a capital city. Kingston [Canada, vol. vi., p. 214], at the north-east extremity of Lake Ontario, is now the capital town of the Province of Canada.

(*The Canadas in* 1841, by Sir R. H. Bonnycastle; *Winter Studies and Summer Rambles in Canada*, by Mrs. Jameson; *Encyclopædia Americana.*)

TORPE'DO, a genus of fishes belonging to the Ray family (*Raiidæ*), founded by Duméril upon the *Raia Torpedo* of Linnæus, and some other species, distinguished by their having the tail short and moderately thick, and the disc of the body nearly circular, the anterior margin being formed by two produced portions from the head, which, inclining sideways, join the pectorals: the space between the head, the pectoral fins, and the branchiæ is occupied by small vertical hexagonal tubes, which are filled with mucous matter, and largely provided with nerves from the eighth pair. The situation of these honeycomb-like cells, which constitute the electrical apparatus, is indicated on the upper surface by a slight convexity on each side of the head.

The shocks given by the torpedo are very considerable, and are supposed to be used by the animal both as a means of defence and to disable its prey. Mr. Couch is of opinion that this electric apparatus has further uses:—'One well-known effect of the electric shock,' he observes, 'is to deprive animals killed by it of their organic irritability, and consequently to render them more readily disposed to pass into a state of decomposition, in which condition the digestive powers more speedily and effectually act upon them. If any creature more than others might seem to require such a preparation of its food, it is the Cramp-Ray (or Torpedo), the whole canal of whose intestine is not more than half as long as the stomach.' The torpedo occurs occasionally on the British coast, and was first discovered to be a native of our seas by Mr. J. Walsh, who obtained specimens from Torbay. Col. Montagu, in his MS. notes, quoted by Mr. Yarrell, mentions having met with two examples of the torpedo: the first was of small size, and was taken at Torcross, where it was quite unknown to the fishermen; the second was taken on a turbot-hook off the coast of Tenby in Wales, and was of very large size, weighing about one hundred pounds.

The following is Pennant's description of this fish:—Head and body indistinct, and nearly round; greatest breadth two-thirds of the entire length; thickness in the middle about one-sixth of the breadth, attenuating to extreme thinness on the edges; mouth small; teeth minute, spicular; eyes small, placed near each other; behind each a round spiracle, with six small cutaneous appendages on their inner circumference; branchial openings five in number; skin everywhere smooth; two dorsal fins on the trunk of the tail; tail one-third of the entire length, tolerably thick and round; the caudal fin broad and abrupt; ventrals below the body, forming on each side a quarter of a circle; colours, cinerous-brown above, whiteish beneath.

Whether this be the *Raia Torpedo* of Linnæus is difficult to determine. Cuvier and Risso consider that several species have been confounded under that name, and the latter of these authors has characterised four species in his 'Histoire Naturelle de l'Europe Méridionale.' They are:—

1. *Torpedo Narke*, which he describes as being yellowish-red above, and having five ocellated spots.
2. *Torpedo unimaculata.* This species has the body above fulvous, spotted with whiteish spots, and one oblong ocellated spot in the middle of the back. The tail is more elongated and slender. It is said to have the electrical apparatus scarcely visible, and to give but very slight shocks.
3. *Torpedo marmorata.* Body flesh-coloured, and having brown spots and sinuous markings, producing a marbled appearance: tail thick, above rounded.
4. *Torpedo Galvani.* Body fulvous, immaculate, but margined with black.

Flemming refers the British torpedo to the third of these species, *Torpedo marmorata.*

TORPE'DO, a machine invented by Robert Fulton for destroying ships from beneath, by attaching to them carcasses or cases charged with explosive and combustible matter. These were to be applied to the vessels to be destroyed by means of a kind of submarine boat, in the working of which Fulton attained considerable success. He applied his torpedos about 1801 to the blowing up of an old brig in Brest harbour; but in an attempt which he shortly afterwards made to destroy a British man-of-war, he failed, owing to the vessel suddenly changing her position. Upon this failure, Bonaparte, who had borne the expense of the previous experiments, withdrew his support, and the scheme was never brought into practical operation.

TORQUEMA'DA. [Office, Holy.]

TORRE, DELLA, or TORRIA'NI, a powerful family of the middle ages. [Lombardy and Lombard Cities.]

TORRE, FILIPPO DEL, born at Cividale in the Friuli, in 1657, studied at Padua, and afterwards went to Rome in 1687, where he was employed in several offices, and at last was appointed bishop of Adria by Clement XI., in 1702. He died in 1717. While at Rome he published a work of great research on the antiquities of Antium, 'Monumenta veteris Antii,' which was much esteemed by the learned. He wrote some other works in illustration of antient medals, and also upon subjects of natural history. Girolamo Lioni wrote a biography of Filippo del Torre. (Tiraboschi, *Storia della Letteratura Italiana.*)

TORRE, GIAMMARI'A DELLA, born at Rome of a Genoese family, at the beginning of the eighteenth century, after studying in the college Nazareno, entered the order of the Somaschi, and having shown great aptitude for physical and mathematical studies, was successively professor in several colleges at Rome, Venice, and Naples. At Naples he became known to king Charles V. of Naples (afterwards Charles III. of Spain), who employed him in several scientific experiments, and made him his head librarian and keeper of the Museum of Capo di Monte. He published a history of Vesuvius, 'Storia e Fenomeni del Vesuvio esposti dal P. Gio. Maria della Torre, Somasco,' fol., Naples, 1755. He also wrote a 'Course of Physics,' in Italian and Latin, which has gone through several editions; a volume of microscopical observations, and numerous memoirs on scientific subjects. He applied himself particularly to improve the microscope. He also contributed to illustrate the newly discovered towns of Herculanum and Pompeii. He was one of the most distinguished members of the Academy of Sciences of Naples, and was also corresponding member of the Academies of Sciences of Paris and Berlin, and of the Royal Society of London. Father della Torre died at Naples at a very advanced age, in March, 1782.

(Lombardi, *Storia della Letteratura Italiana nel Secolo XVIII.*)

TORRE, FILOMARI'NO, DUKE DELLA, a Neapolitan nobleman who lived in the second half of the eighteenth century, and applied himself strenuously to the study of physics. His name is known in history chiefly for his melancholy end. In the first insurrection of the populace of Naples, who, being forsaken by the king and court and all the principal authorities on the advance of the French invading army, rose tumultuously in January, 1799, to defend the town and at the same time to destroy those whom they suspected of being favourably inclined towards the French, the Duke della Torre, who lived in great retirement and does not appear to have meddled with politics, was denounced to the popular committee by a menial who had seen a letter written to the duke by a noble relative of his at Rome, informing him that he had recommended him to the French general for protection in the event of Naples being stormed by the French army. This was sufficient to persuade the ignorant lazzaroni that the duke was a secret Jacobin, and his doom was fixed at once. The mob went to his palace, pillaged it, destroyed his library, his collection of natural history, and his cabinet of physics, threw the furniture out of the window, seized the duke and his brother the Cavaliere Clemente Filomarino, known for his poetical talent, and dragged them to the Marina of the Carmine, where they killed both of them. At the same time it must be observed that the leaders of the mob showed some regard for the women and children; they ordered one of the duke's carriages out, put the duke's wife and her children in it, and told them to drive to some friend's or relative's, after which they set fire to the palace. The two brothers Filomarino were the most distinguished victims of the first or Lazzaroni insurrection of 1799.

(Colletta, *Storia del Reame di Napoli*; Cuoco, *Saggio Storico sulla Rivoluzione di Napoli*; *Sketches of Popular Tumults*, London, Knight and Co., 1837.)

TORRE DEL GRECO. [Naples, Province of.]

TORRE'NTIUS LÆVI'NUS, whose original name was Van der Beken, was born at Ghent in 1525. He studied at Louvain, and was in the town when it was besieged by the celebrated Martin van Rossem. To commemorate the successful defence of the inhabitants, Torrentius composed a Latin poem, which was highly thought of at the time. He subsequently travelled to Italy, and spent some time at Bologna; at Rome however he remained many years, and studied Roman antiquities there with great diligence. He enjoyed the friendship of the Cardinal Baronius, Antonius Augustinus, Fulvius Ursinus, and other celebrated scholars during his residence at Rome; and he also made there a fine collection of antient coins and works of art. On his return to the Netherlands, Torrentius filled successively various ecclesiastical dignities, and was at length appointed to the bishopric of Antwerp, where he laboured with great zeal in discharging the duties of his office. He is said to have been also employed in various embassies and political negotiations. In 1595 he was appointed archbishop of Mechlin, but before the documents arrived from Rome which were necessary to enable him to enter upon his new dignity, he died at Brussels in the seventieth year of his age. He was buried in the cathedral-church of Antwerp. He left his library and collection of antiquities to the college of Jesuits at Louvain.

Torrentius was an accurate scholar, and well acquainted with Roman antiquities, but he did not write much. The only work of his which was published in his lifetime is a Commentary on Suetonius, which originally appeared at Antwerp in 1578, and was reprinted in 1592: it is also contained in Grævius's edition, published in 1672. This Commentary is also interesting from the many wood-cuts it contains, representing coins of the Roman emperors and their families. Torrentius's Commentary on Horace was not published till after his death: it appeared at Antwerp in 1608, 4to., together with a small treatise of his, entitled 'Commentariolus ad Legem Juliam et Papiam de Matrimoniis Ordinandis.' Besides these Commentaries, Torrentius also published in his lifetime several Latin poems, of which a collection appeared at Antwerp in 1576, 8vo., under the title of 'Poemata Sacra.' Torrentius was called by his contemporaries the Christian Horace; and his poems are distinguished by great ease of versification. He also edited the posthumous works of J. Goropius Becanus, Antwerp, 1580, with an apology for Becanus, who had been attacked by Scaliger. (Foppens, *Bibliotheca Belgica*; Saxii *Onomasticon.*)

TORRES STRAIT was named after the Spanish navigator Luis Vaez de Torres, who was the first to pass through it, which event took place in 1606. It is situated between the most north-eastern part of Australia and the southern coast of Papua or New Guinea. As the large peninsula which projects from the main-land of Australia northward between the Pacific and the Gulf of Carpentaria grows narrower as it proceeds northward, and terminates with a coast extending not much more than 30 miles from east to west, Torres Strait, in a geographical point of view, does not exceed that distance in its direction from east to west, and is situated between 142° and 142° 40′ E. long. The most northern point of Australia, Cape York, is in 10° 42′ S. lat., and the opposite coast of Papua, which has only been seen from a distance, and not been visited by navigators on account of the numerous dangers with which it is beset, is laid down on our charts in 9° 15′ S. lat. Thus the extent of the strait from south to north is about 100 miles. Navigators however give to the strait a much greater extent, as they consider it to begin on the east with the Pandora Entrance, situated between extensive reefs near 144° 40′ E. long., so that, according to them, Torres Strait extends from 142° to 144° 40′ E. long., or 180 statute miles from east to west. They have been induced to adopt the Pandora Entrance as the beginning of the strait, because at that point the dangers attendant on the navigation of the strait begin to surround them on all sides, and do not cease until they have passed to the west of 142° E. long.

The reefs, which lie on the south and north of Pandora

Entrance, are isolated, and surrounded by a deep sea, which extends westward about 30 miles. At that distance however occurs a most extensive reef, which runs from north to south between 9° 53′ and 11° 25′ S. lat. without a break, and by which the strait is shut up on the east; for the strait can only be entered by the narrow passages which are to the north or south of this steep coral reef, and the whole space which lies to the west of the reef is dotted by islands, shoals, rocks, and reefs of various but not great extent. Between them are the narrow winding passages by which the vessels pass through the strait. It is easily comprehended that such vessels cannot remain under sail during the night. The islands are neither large nor numerous, except in the narrowest part, between the most northern part of Australia and the southern coast of Papua, where there are several islands of moderate extent, which are considered as one group, and comprehended under the general name of Prince of Wales Islands.

Since the establishment of the English colonies in New South Wales, Torres Strait has frequently been navigated, notwithstanding the dangers which are encountered in passing it, as it offers a much shorter route between those colonies and Hindustan than the eastern and western routes, of which the former passes to the east of the Corallian Sea [PACIFIC, vol. xvii., p. 118], of Louisiade, and Papua, and the western round the continent of Australia, or more commonly round Tasmania. By these two routes vessels usually reach the Indian Archipelago and Hindustan two or three weeks later than by the route through Torres Strait, and as it usually occurs in such cases, the dangers of the strait are now better known and easily avoided. But the strait can only be navigated between March and September, during the south-east monsoon: in the other six months of the year, or during the period of the north-west monsoon, the fogs prevail in the strait to such an extent, that no vessel can venture to enter among its almost innumerable reefs and rocks. Besides, Torres Strait is only navigated by vessels bound from New South Wales to Hindustan, and not by those which sail in an opposite direction. The latter would always have to contend against contrary winds; for when the south-east monsoon terminates, the trade winds begin, and blow steadily and with considerable force all the rest of the year. This last circumstance greatly favours the passing of vessels from Sydney to Hindustan, but must render it almost impossible to reach Sydney by the same route.

Two different routes are taken by vessels in sailing to Torres Strait, and in passing through it. They are distinguished as the Inner and Outer route. The Inner route lies along the coast of Australia, and between it and the Great Barrier Reefs. These reefs begin, according to Flinders, in 22° 50′ S. lat. and 152° 40′ E. long., and extend nearly parallel to the coast of Australia to Torres Strait, through 14° of lat. and 9° of long., and are as to length not equalled in any other part of the world. Their breadth seems to be about 50 or 60 miles in their southern part, but diminishes to the northward. At low-water a part of them is dry, and there are numerous small black rocks on them, but at high-water very little of them is seen. Only a few narrow openings occur in these barrier reefs, and one large one, which is found at 18° 52′ S. lat., and which is about 20 miles wide. The arm of the sea enclosed between the barrier and the coast is from 60 to 80 miles wide towards the south, but it contracts gradually to 20 miles near the great opening, and is still narrower farther north. Numerous islands are scattered in this enclosed space, but no other coral-banks occur except those which surround some of the islands. Being sheltered from the strong swell of the Pacific by the barrier, the water is smooth, and it also offers the advantage of regular soundings, its depth not being very unequal, and varying only from 60 fathoms at the southern end to 30 fathoms at the great opening, and to 20 at Cape Tribulation. Though those who first investigated this part of the Pacific had to encounter numerous difficulties, and were more than once in imminent danger, it seems that it offers the safest route for vessels which are not very large, and it appears that it has lately been adopted as the common route of communication between Sydney and Essington, the newly established settlement in North Australia. Vessels sailing by this track pass through Torres Strait by sailing round Cape York and through Endeavour Strait. The last-mentioned strait is formed by the mainland of Australia and some of the islets belonging to the Prince of Wales Islands, and constitutes the southern part of Torres Strait. It is about 30 miles long, and from two to six miles wide, and offers a safe passage for vessels of good size.

The Outer route, which lies through the Corallian Sea, is dangerous, owing to the great number of reefs which are dispersed over it north of the southern tropic. After passing through Pandora Entrance the vessels enter Torres Strait by sailing north of the long reef, situated at the entrance of the strait (144° E. long.), to Murray Islands, and traverse the strait by sailing west-south-west between innumerable low islands, shoals, and rocks. They do not enter Endeavour Strait, but keep at the distance of about 20 miles from it to the northward, until they have passed on the north of Wednesday and Good's Islands, when they leave the strait and enter the Indian Sea.

(Cook's *First Voyage;* Flinders's *Voyage to Terra Australis;* Horsburgh's *Indian Directory;* Earl's *Account of a Visit to Kisser*, in *London Geograph. Journal*, vol. xi.)

TORRES VEDRAS, a town of Portuguese Estremadura, about twenty-five miles north-north-west of Lisbon, and about eight miles from the sea-coast. The small river Zizandre flows in a ravine by Torres Vedras, separating the ridge which runs from east to west across the peninsula in which Lisbon is situated, from the lofty ridge called Serra de Baragueda, which runs from north to south in a direction almost perpendicular to the former. [ESTREMADURA, PORTUGUESE.]

Torres Vedras is become an historical name in consequence of the lines of defence constructed by Lord Wellington along the sinuosities of the hilly tract which extends from the Tagus to the sea, so as to protect the peninsula of Lisbon from invasion, and in which he awaited and baffled the attack of the French army under Marshal Massena in the autumn of 1810. 'The line of defence was double: the first, which was 29 miles long, began at Alhandra on the Tagus, crossed the valley of Aruda, which was rather a weak point, and passed along the skirts of Monte Agraça, where there was a large and strong redoubt; it then passed across the valley of Zibreira, and skirted the ravine of Runa to the heights of Torres Vedras, which were well fortified, and from thence followed the course of the Zizandre to its mouth.' . . . . 'The second line, at a distance varying from six to ten miles in the rear of the first, extended from Quintella on the Tagus, by Bucellas, Monte Chique, and Mafra, to the mouth of the little river S. Lourenço on the sea-coast, and was about 24 miles in length. This was the stronger line of the two by nature and art; and should the first line be forced by the enemy, the retreat of the army upon the second was secure at all times. Both lines were protected by breastworks, abattis, stone-works with banquettes, and scarps. In the rear of the second line there was a line of embarkation, should that measure become necessary, enclosing an entrenched camp and the Fort S. Julian. More than 100 redoubts or forts, and 600 pieces of artillery, were scattered along these lines. About 60,000 men, between English, Portuguese, and Spaniards, were posted along the first and second lines. A flotilla of gun-boats flanked the right of the position.'

(*The Military Life of the Duke of Wellington*, in Knight's *Store of Knowledge*.)

TORRICELLI, EVANGELISTA, a learned Italian mathematician and philosopher, was born October 15, 1608, at Piancaldoli in Romagna, and being, probably at an early age, an orphan, he was supported by an uncle who resided at Faenza. At this place, and in a school of the Jesuits, the youth received a mathematical education, and he speedily distinguished himself by the progress which he made in acquiring a knowledge of the sciences.

At twenty years of age his uncle sent him to Rome, where he became intimately acquainted with Benedict Castelli, who was then professor of mathematics in that city, and by whom his studies were directed. The Dialogues of Galileo appear to have particularly engaged Torricelli's attention, and he composed two tracts, one on the subject of mechanics, and the other on the motion of fluids, which were published with the rest of his mathematical works in 1643. Torricelli seems to have been the first who established the principle, that when two weights are so connected together, that being placed in any position their common centre of gravity neither ascends nor descends, those weights are in equilibrio; and on this principle he investigated the ratio between two weights when they are in equilibrio on a double inclined plane. He also investigated the motions of falling bodies and projectiles; and among the results of his researches is the remarkable fact, that the paths of any number of projectiles (in a non-resisting medium) when discharged from the same point with equal velocities, but at different angles of elevation, are parabolas situated within one curve which is a tangent to all of them, and is itself a parabola. In the tract on the motion of fluids, he assumes that water will flow through an orifice at the bottom of a vessel with a velocity equal to that which would be acquired by a body falling through the height of the fluid in the vessel, and he endeavours to establish the principle by the supposed fact that water so flowing ascends in a vertical tube connected with the vessel at the orifice (the resistance of the air being abstracted) to the level of the upper surface of that which is in the vessel: he hence concludes that the velocities of effluent water must vary with the square-roots of the pressures.

Galileo, having received copies of the tracts above mentioned, was desirous of becoming acquainted with the author, and he pressed the latter to join him at Florence. Torricelli, having formed connections at Rome, at first hesitated, but at length decided to accept the invitation: he was kindly received by Galileo, and it is said that his society and conversation contributed to soothe the last days of the venerable philosopher, who was then infirm and blind, and who died at the end of three months from his arrival. Having been honoured by the grand-duke with the appointment of professor of mathematics in the Accademia, Torricelli became the successor of Galileo in the institution, and he resided at Florence till his death, which happened in 1647, when he was thirty-nine years of age.

About the year 1637 Roberval, in France, discovered a method of determining the area of a cycloid, and seven years later Torricelli published a solution of the problem in an appendix to the collection of his works. As the Italian mathematician appeared to consider himself to be the discoverer of the rule, Roberval's jealousy was excited, and he accused Torricelli of plagiarism; asserting that the latter had taken the solution from some papers which had been sent to Galileo, and which had fallen into his hands on the death of that philosopher: Torricelli however, in a letter to Roberval, denies that assertion, and there seems no reason to doubt that he made the discovery without any knowledge of what had been already done in France. He subsequently gave rules for finding the volumes of the solids formed by the revolution of a cycloid about its base and about its axis; that which is applicable to the first case is correct, but the other is only approximative, so that it may be doubted whether or not Torricelli was in possession of an accurate solution of the problem.

But the discovery which has immortalized the name of Torricelli is that of the barometer. Galileo had occasion, some time previously, to observe that a column of water exceeding 18 cubits (about 33 feet, English) in height could not be raised in a pump; and, though he had already made the discovery of the pressure of the atmosphere, the reason why that limit could not be exceeded remained unknown to him. Torricelli, in 1643, wishing to find, in a more convenient manner, the weight of the quantity of fluid which could be supported above its general level, performed an experiment similar to that which is exhibited when a pump is in action; and, instead of water, he used mercury, which is about fourteen times as heavy. He filled with mercury a glass tube which at one end was hermetically closed, and having inverted it, he brought its open extremity under the surface of mercury in a vessel; when he observed that the top of the column descended till it stood at a height equal to between 29 and 30 inches (English) above the level of the mercury in the vessel, leaving what is considered as a perfect vacuum between the upper extremity of the column and that of the tube. The specific gravity of mercury being known, the weight of the supported column could, of course, be found.

By this experiment the opinion that a vacuum was contrary to a law of nature was immediately proved to be unfounded, but it is uncertain whether or not Torricelli was aware of the true cause of the column of mercury being so supported, and the honour of having been the first to prove decisively that it was the pressure of the atmosphere on the surface of the mercury in the vessel, is ascribed to Pascal, who, in 1648, on conveying a tube so filled to stations at different heights above the level of the plains, found that the column of mercury diminished in length as the station was more elevated; that is, as the weight of the column of atmosphere above the vessel diminished.

It may be easily conceived that Torricelli would communicate his ideas to his friends before he actually made the experiment above mentioned; and such a circumstance may account for the pretensions of Valerianus Magnus, Honoratus Fabri, and others, to priority in the discovery of what is called the Torricellian vacuum. It ought to be observed however that in one of the letters of Descartes, dated 1631, that is, twelve years before the experiment of Torricelli was made, this philosopher mentions the support of a column of mercury in a tube, and expressly ascribes the cause to the weight of a column of air extending upwards beyond the clouds.

Torricelli published at Florence, in 1644, a volume in 4to., entitled 'Opera Geometrica.' A paper which he wrote on the course of the Chiana is in the collection of writings on the movement of fluids (Florence, 1768). His discovery of the barometer is given in his own work on mathematical and physical subjects, entitled 'Lézione Accademiche' (Florence, 1715). And his letter to Roberval on the cycloid is in the third volume of the 'Mémoires' of the Academy of Sciences at Paris. He is said to have been the inventor of the small simple microscopes of short focus, which consist of a globule of glass melted in the flame of a lamp. His manuscripts are preserved in the Medicean Palace, and in the same edifice there are some object-glasses for telescopes, of considerable dimensions, which bear his name.

TORRID ZONE. [ZONE.]

TORRIGIA'NO, PIE'TRO, an Italian sculptor, whose name is connected with the history of art in this country, he being one of the foreign artists employed by Henry VIII., was hardly less remarkable for the ferociousness of his temper, the singularity of his conduct, and the strangeness of his fate, than for his ability in his profession. He was a native of Florence, and though the time of his birth is not mentioned, it was probably about the same as that of Michael Angelo (1474), as they studied together from the antiquities in the gardens of Lorenzo de' Medici, il Magnifico; a circumstance which Michael had good cause to remember, for such was Torrigiano's jealousy of and spite towards him, that he one day assaulted him, and inflicted so severe a blow upon his nose as to crush and disfigure it for ever. Being obliged to flee from Florence in consequence of this affair, Torrigiano went to Rome, where he was employed by Pope Alexander VI., and afterwards enlisted and served as a soldier, first under the duke Valentino in Romagna, next under Vitelli and Piero de' Medici. Strange as this change was, he was well suited to his new profession, and that to him; for, as described both by Vasari and Cellini, he was a large, handsome, and powerful man; was gifted with great 'audacity, and had more the air of a rough soldier than of an artist.' But though he distinguished himself by his prowess, and obtained the rank of ensign, he saw no chance of speedily advancing higher, and therefore returned to his former profession, which he practised for awhile, but only, it would seem, in small bronze figures, executed for some Florentine merchants, whom he afterwards accompanied to England. His talents, and perhaps his personal qualities also, recommended him to the favour of Henry VIII., for whom he executed a variety of things, but his chief work was the tomb of Henry VII. in Westminster Abbey, which he completed in 1519, and for which he received the sum of 1000*l*. The tomb of Margaret, countess of Richmond, in Henry VII.'s chapel, is also supposed to have been by him.

While engaged upon Henry's tomb he returned to Italy, in order to carry back with him other assistants, and endeavoured to persuade Benvenuto Cellini, then only eighteen, to accompany him; but the latter tells us he was so disgusted with Torrigiano, on learning from him how brutally he had treated Michael Angelo, that so far from associating with him in any way, he could not even endure the sight of him.

After finally quitting England in 1519, Torrigiano visited Spain, where he executed several pieces of sculpture for convents, &c., and among others, a Virgin and Child, so beautiful that the duke d'Arcos commissioned him to make a copy of it. The payment promised for it seemed such an immense sum, that the artist fancied he was about to be rendered wealthy for the rest of his days; so great therefore was his indignation on discovering that the vast heap of maravedis sent home to him amounted to no more in value than thirty ducats, that he went and broke the statue to pieces. On this, the duke caused him to be imprisoned in the Inquisition as a sacrilegious heretic who had impiously destroyed a figure of the Holy Virgin. He was accordingly condemned by that tribunal, but avoided the execution of his sentence by refusing to take any food; preferring starving himself to death to the more ignominious end which else awaited him. Thus perished, in 1522, an artist of more than ordinary talent: a victim partly to his own violence and imprudence, and partly to the mercilessness of a most odious and sanguinary tribunal. (Vasari, *Vite*; *Vita di Benvenuto Cellini*.)

TORRINGTON. [Devonshire.]

TORS. By the natural weathering of rocks exposed to atmospheric vicissitudes, the perishable parts are removed and the more resisting portions remain. In rocks which manifest peculiar arrangements of joints or natural divisions, the blocks and masses defined by their intersections often appear in cubical, subcolumnar, and other characteristic shapes. To masses more or less characteristic in figure, left by the decay of surrounding parts in prominent situations, the name of 'Tor' is applied in the granitic tracts of Devon and Cornwall. Examples may be seen in almost every district of granite, millstone-grit, and massive conglomerate, such as that which forms the top of the old red-sandstone near Monmouth. In some instances the weathering process (which proceeds most rapidly to waste the stone in sheltered parts) undermines the mass of rock, so as to leave it standing on a narrow pedestal (Brimham rocks in Yorkshire, for example, or the 'Buckstone' near Monmouth). Finally, this pedestal is worn away, and the stone falls to take a new position. It may happen, owing to the figure of the stone and the place of the centre of gravity, that in its new situation the stone may rest upon so narrow a base as to be easily displaced to a small extent by the hand. It is then a 'rocking-stone,' such as occur in Cornwall, in Yorkshire, and in many other situations, where the labour of Druids has been invoked to account for a simple operation of nature. (MacCulloch, in *Geol. Trans.*, 1st series, vol. ii.; De la Beche's *Manual of Geology*; Phillips's *Geol. of Yorkshire*, vol. ii.)

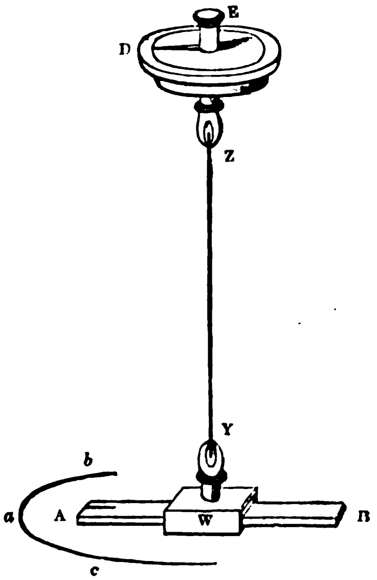
TORSCHOK is a considerable town of European Russia, in the government of Twer: next to the capital, it is the most important town in that government. It is situated on the right bank of the river Twerza, on the high road between St. Petersburg and Moscow, and is divided into two parts by the river which runs through it, and over which there is a bridge of boats. It is surrounded with palisades, and has broad streets and spacious market-places, which however are not paved. Of the fortifications nothing remains but the ramparts, which are planted with birch and converted into public walks. The houses are partly built of brick; and there are twenty-three churches, among which the cathedral, which has been rebuilt within these few years, is worthy of notice. From the castle on the hill there is an extensive and beautiful prospect. The town is large, and has a striking effect when viewed at a distance; the interior does not correspond with the exterior appearance. It is very old, and has always shared the fate of Novgorod; after being frequently pillaged by the Tartars and the princes of Twer and Moscow, it has always recovered itself, and is partly indebted for its agreeable appearance to Catherine II., who relieved it after a great fire in 1769. The population of Torschok is stated by Hassel, above twenty years ago, at 15,000; yet Schnitzler, in 1835, thinks that estimate much too high. The inhabitants manufacture boots, slippers, caps, portfolios, and other articles of embroidered morocco. Few travellers pass through this city without purchasing some articles of this kind, and they pay a higher price on the spot than at St. Petersburg and Moscow, where very large quantities are sold. The boots and caps of Torschok are sold as the manufacture of Turkey and Persia.

(Schnitzler, *La Russie, la Pologne, et la Finlande*; Stein, *Geographisches Lexicon*; Hörschelmann; Hassel; Cannabich.)

TORSELLINO. [Tursellinus.]

TORSION is that force with which a thread or wire returns to a state of rest when it has been twisted by being turned round on its axis: the thread or wire, which is suspended vertically, is attached at the upper extremity to some object, and at the lower extremity is a weight with a horizontal index, or a stirrup, which is to carry a needle or bar in a horizontal position.

Let Z Y be the wire, W the weight or stirrup, and A B an index or needle, and let *b a c* be part of a graduated ring on the same level as the needle; then, on turning the object W round till a mark on the extremity A of the index is brought to any point, *b*, on the ring, the wire becomes twisted; and when the power by which W is turned is removed, the elasticity of the wire causes the point at A to oscillate within the ring through an arc, as *b a c*, which continually diminishes till the index rests in its original position.



In the article Elasticity (p. 327) there is given an investigation from which it is proved that, while the force of torsion is moderate, its intensity is directly proportional to the angle or arc through which the extremity A of the index is moved in twisting the wire. It is also there proved that T, the time of a complete oscillation, is constant, or that the vibrations are isochronous, like those of a pendulum which is acted upon by gravity; and further, that when a body, as W, is suspended, the squares of the times of vibration vary directly as the momentum of the body's inertia, and inversely as the force of torsion: consequently when the forms and weights of suspended bodies are the same, the force of torsion varies inversely with the square of the time. With respect to the effects which a variation in the length of the wire will cause in the force of torsion, it may be observed that in proportion as the lengths of the wires are increased, points at the lower extremities must be turned, about the axis, through greater arcs, in order to produce equal degrees of torsion at equal distances from the points of suspension; and hence, if the number of revolutions be equal, the force of torsion will be inversely proportional to the length of the wire: it follows therefore that the time of a vibration varies directly with the square-root of the length of the wire.

These deductions from theory are confirmed by their agreement with the results of the numerous experiments made by M. Coulomb with an apparatus similar to that which is above represented; the times in which a certain number of isochronous vibrations were made with wires of different lengths, and carrying at their lower extremities cylinders of different weights, being observed. By comparisons also of experiments on wires of the same length and of different diameters, consequently of different weights, Coulomb found that the times of vibration were inversely proportional to the weights, or to the squares of the diameters of the wires; and since the force of torsion varies inversely with the squares of the times, it follows that when the wires are of the like material and of equal lengths, the force of torsion varies directly with the fourth power of the diameter. M. Poisson, in a memoir on the equilibrium and movement of elastic bodies, which is given in the 'Mémoires de l'Académie des Sciences' (tom. viii.), has deduced the same law from purely theoretical considerations.

It may be convenient to compare the force of torsion with that of gravity, and for this purpose it will be necessary to observe merely that the time in which a pendulum, whose length is l, makes a complete oscillation in a very small arc is expressed by $\pi\left(\frac{l}{g}\right)^{\frac{1}{2}}$ [PENDULUM, p. 406], where g represents the force of gravity: then the time in which the torsion wire vibrates once on its axis being made equal to the time in which a simple pendulum vibrates, we have (using the formula in ELASTICITY), $\frac{K^2M}{n} = \frac{l}{g}$; therefore as the momentum of inertia for a torsion wire suspending a body of a given form can be computed, and as l may be found from the observed time of a vibration, the value of n (the coefficient of the force of torsion) can be ascertained from this equation.

The torsion of slender wires was first employed by Coulomb for the purpose of determining the intensities of forces in nature and the laws of their action in circumstances which render direct methods inapplicable: his experiments were performed with an instrument which he invented, and which he designated a *torsion balance*. In the article ELECTROMETER there is given a description of the instrument and of the method of employing it in finding the laws of electric attractions and repulsions; and it will therefore be sufficient in this place to explain its application in determining those of magnetic action. For this purpose Coulomb adapted to the suspending wire, which was of copper, a small stirrup, as W, also of copper, in which could be placed a magnetized needle of steel. Before this was done however, a copper needle, equal in weight to the magnetized needle which was to be used in the experiment, was placed in the stirrup, and the plate D at the top of the glass case was turned round till one extremity of the copper needle, which turned with the plate, was brought to the zero of the graduations on the horizontal circle *b a c* in the case, the suspending wire being in an untwisted state: the whole case was afterwards turned round till the needle, still pointing to zero, was in the direction of the magnetic meridian, which had been previously determined. The copper needle was then taken away, and the magnetized needle put in the stirrup; and as soon as it was at rest in the magnetic meridian, the suspending wire was twisted by turning the stem E, to which it is attached at the upper extremity of the case, till the index there had passed over some given number of degrees, which in one experiment was 360. The suspended needle was thus made to deviate from its previous position 10½ degrees, in which state the horizontal force of terrestrial magnetism was in equilibrio with the force of torsion; and the angle of torsion was then equal to 349½° (= 360° − 10½°). On turning the index at E through two revolutions, the needle was observed to rest between the opposing forces, at 21¼° from its original place, when consequently the angle of torsion was 698¾° (= 720° − 21¼°). Obtaining in like manner several other angles of torsion with the corresponding deviations of the magnetic needle, and comparing them together, Coulomb found that the forces of torsion are constantly proportional to the sines of the deviations of the needle.

In order to discover the law of magnetic action with respect to the distances between the attracting or repelling bodies, Coulomb placed a magnetized needle in the stirrup of the balance, and after twisting the wire by turning the micrometer stem at E on its axis through a certain number of degrees, he observed where the needle rested between the opposing forces of torsion and the horizontal component of terrestrial magnetism: assuming then that the deviations of the needle were proportional to the forces of torsion, he found that, in order to make the needle deviate one degree, it was necessary to employ a force of torsion expressed by 35 degrees. The wire being then untwisted, and the magnetized needle placed in the magnetic meridian, Coulomb introduced in the glass case, in a vertical position, and also in the plane of the magnetic meridian, a magnetized needle of the same dimensions as the other, so that if the two needles could have approached each other they would have been in contact at about an inch from the extremity of each; but the poles of the same denomination in the two needles being presented to each other, a repulsion took place, and the suspended needle came to a state of rest between the opposing forces of torsion and of magnetic repulsion. When the micrometer at E was allowed to remain in its actual position, the suspended needle was repelled 24 degrees, and consequently it was prevented from returning to the zero point by a force of torsion expressed by the sum of 24 degrees, and of the horizontal force of terrestrial attraction (= 24 × 35°, or 840°); thus the whole force of magnetic repulsion was expressed by 864 degrees. In a second experiment, the wire being twisted by making the stem at E perform three revolutions (= 1080°) in a direction contrary to that of the 24 degrees before mentioned, the needle rested at 17 degrees from zero: the force of magnetic repulsion was then expressed by the sum of 1097 degrees, and the value of terrestrial attraction (= 17 × 35°, or 595°); that is, in all, 1692 degrees. On comparing together several experiments of the same nature, and also several similar experiments in which the poles of a contrary denomination were presented to each other, Coulomb found, neglecting small differences which may be supposed to have arisen from the extent and configuration of the needles, that the forces of magnetic repulsion and attraction vary inversely as the squares of the distances.

The 'bifilar magnetometer' which was invented by M. Gauss, is a species of torsion balance: it is described briefly in the article TERRESTRIAL MAGNETISM, and at length in Taylor's 'Scientific Memoirs,' vol. ii., part 6. The apparatus with which, by the oscillations of two balls of lead at the extremities of a lever suspended horizontally by a string, Mr. Cavendish determined the average density of the earth, was also a balance acting on the same principle. [ATTRACTION, p. 68.]

For the strain of torsion in machinery, see MATERIALS, STRENGTH OF.

TORTENSON. [THIRTY YEARS' WAR.]

TORTI, FRANCIS, an eminent Italian physician, was born at Modena, December 1st, 1658. Having finished his preliminary studies in 1675, he was originally intended for the legal profession; this however he soon abandoned, and embraced that of medicine, which he studied under Antonio Frassoni. He took the degree of Doctor of Medicine at Bologna in 1678, and upon his return to Modena, at the early age of twenty-three, he obtained one of the medical professorships founded by the duke Francis II. Soon afterwards he was chosen to be one of the physicians in ordinary to the duke, an appointment which he owed partly to his accomplishments in music and literature, as he was the composer of several oratorios, and also wrote a Latin letter under the assumed name of L. A. Cotta, in defence of Tasso against Bouhours. Upon the death of Francis in 1694, his successor continued Torti in his place of physician in ordinary; he was also prevailed upon by his representations to found an anatomical amphitheatre at Modena, in which Torti was entrusted with the office of demonstrator in 1698. He had previously joined with Ramazzini in carrying on some researches concerning the barometer, the results of which were published by the latter under the title 'Ephemerides Barometricae Mutinenses,' Modena, 1694; and again 'Dissertatio altera Triceps circà Mercurii Motiones in Barometro,' Modena, 1698. But Torti's most important and celebrated work did not appear till 1709, under the title 'Therapeutice Specialis ad Febres quasdam Perniciosas, inopinato ac repente Lethales, una verò China China Peculiari Methodo ministrata,' Modena, 8vo. This work placed him at once in the first rank among practical physicians, and still continues to be highly esteemed. It has been several times reprinted, the last edition (of which the writer is aware) being published at Paris, 1821, 8vo., in 2 vols. The publication of this work gained him the friendship and applause of various learned men, and also the title of corresponding member of the Royal Society of London, and of the Academy of Valentia in Spain. It also drew forth some criticisms from Manget and Ramazzini, to whose remarks he replied with some degree of bitterness and warmth. In 1717 he was offered the professorship of Practical Medicine at Turin, and in 1720 he had a similar offer at Padua, but he refused them both, and preferred living at Modena, where he had honours and emoluments heaped upon him by the duke. An incurable trembling of the hands having rendered him unable to feel the pulse of his patients with sufficient accuracy, he gave up practice some years before his death, and passed the remainder of his life in honourable repose, often consulted by patients from all parts, and spending much of his leisure time in the pleasures of the chase, to which he had always been much addicted. Having been summoned by the prince of Parma, in 1731, to attend Henrietta d'Este, he was, upon his return to Modena, seized while in a church with a sudden attack of hemiplegia, brought on probably by heat and over-exertion. For some time afterwards he lost the use of his right side, but gradually recovered, and lived for ten years after the attack. He latterly became dropsical, and died in March, 1741, at the age of eighty-two. He was twice married, but having no children, he left part of his fortune to found another medical professorship at Modena, and directed the rest to be given away in charity. (*Biographie Médicale.*)

TORTOISES (*Testudinata*), a numerous and highly interesting order of REPTILES, generally considered the first by herpetologists. They are also termed *Chelonians*, from χελώνη (chelone), the Greek name for a tortoise, and are distinguished at the first glance by the double shield in which their body is normally enclosed, whether they are terrestrial, fresh-water, or marine: they were all comprised by Linnæus under his genus *Testudo*.

ORGANIZATION.

Skeleton.—The surface of the *skull* in these reptiles is continuous, being without any moveable articulations, as is the case with the *serpents* and the Tailed *Batrachians*. But whilst this character prevails in all the genera of which the order is composed, many of those genera differ much in their cranial structure, and it becomes necessary to point out these differences, which are much greater than those which exist in the crania of the Crocodiles.

In the *Terrestrial Tortoises* the head is oval and obtuse anteriorly; the interval between the eyes is large and convex; the aperture of the nostrils is large, higher than it is wide, and a little depressed backwards. The orbits, which are large, are nearly round, complete throughout, directed sideways, and a little forwards. The parietal region terminates backwards in a large projecting occipital spine, and has on each side two large temporal fossæ, under which are enormous tympanic cavities; behind these cavities, and a little above, project two large mastoidean protuberances, and beneath them are the apophyses, which serve for the articulation of the under jaw. These apophyses descend vertically, and are not directed backwards, as in the *Crocodiles*. Underneath, the basilary region is flat, the palatine concave; and upon the anterior part of this last the osseous posterior nostrils open, there being no palatine roof, and the palatine part of the maxillaries being open up to the anterior fourth of the muzzle; a disposition rendered necessary by the mode of respiration in these animals, and which as much resembles that of the *Frogs* as it differs from that of the *Crocodiles*. The occipital region is in its totality vertical, although the occipital spine, the mastoidean protuberances, and the articular condyle of the skull, which is a very projecting tubercle, render it very unequal.

The first remarkable feature in the composition of the head of the Tortoises, remarks Cuvier, from whose observations the osteology of the order is principally taken, is the absence of nasal bones. In the recent animal the external bony nostrils are narrowed by cartilaginous laminæ, which represent these bones; but in the skeleton is found immediately at their upper border the anterior frontal bone, which takes its ordinary place in the frame of the orbit, is articulated also, as ordinarily, to the ante-orbital apophysis of the maxillary bone, descends within the orbit, forms the anterior septum, which separates the orbit from the nose, and is articulated below with the palatine and the vomer, leaving between it, the maxillary, and the palatine an oblong hole, which leads into the posterior nostrils. The osseous cavity of the nose is oblong, and formed by the maxillaries, the intermaxillaries, the vomer, the two anterior and the two principal frontals. The extent of the anterior frontals and the absence of the nasal bones are the causes that the first articulate with each other, and that they extend above the orbit and outside the principal frontals up to the posterior frontals in *Testudo Indica*, or very near it in some other species. The intermaxillaries have no ascending apophysis. They form, as ordinarily, the termination of the muzzle, and are directed backwards in the palate between the maxillaries, and even between the posterior nostrils, to the vomer. The posterior nostrils are two large apertures pierced on each side in the middle of the nasal cavity between the maxillaries, the intermaxillaries, the vomer, and the anterior frontal bones. The bottom of the cavity of the nose is covered above and closed behind by the principal frontals, which leave a large aperture between them closed by a cartilage which permits the passage of the filaments of the olfactory nerve. Lower and laterally there is, between the frontal, the anterior frontal, and the vomer, a rather large space closed by a continuation of the same cartilage, which represents the os planum. In the terrestrial tortoise there is no interorbital simple cartilaginous septum, or nearly none; but this is not so in other subgenera. The frontals cover but very little of the cerebral chamber, because they are short and together form a lozenge wider than it is long. The parietals form together a pentagon, the most acute angle of which proceeds to unite itself with the occipital spine. They cover more than half of the cerebral chamber, and are directed backwards by means of a scaly suture on the occipital bone and on the petrous bone. On each side the parietal bone descends very low into the temporal fossa; there it occupies nearly all the space which the temporal wing of the sphenoid bone occupies in the crocodile, and in the tortoise there only remains a very small portion of this bone, which unites on one side to the descending portion of the parietal; on the other to the palatine, the internal pterygoid, the body of the sphenoid, the tympanic cavity, and the os petrosum.

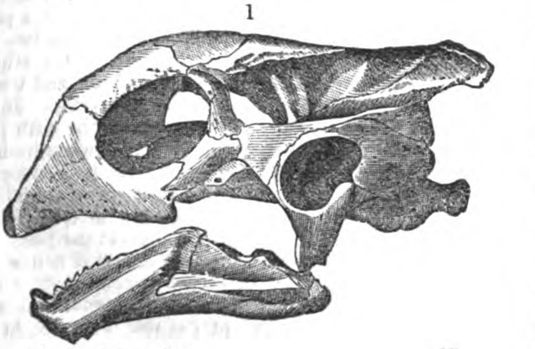
In the *Chelone Mydas* (tortue franche) it is still smaller and joined to the descending foot of the descending portion of the parietal bone. The jugal bone is articulated, as ordinarily, with the external and posterior angle of the maxillary bone. It is narrow and continued under the orbit, behind which it encounters the posterior frontal bone, which completes the frame in this part, and the squamous portion of the temporal bone, which forms by itself the whole zygomatic arch, as may be seen in many of the *Cetacea*. The temporal bone widens to unite itself to the tympanic cavity, which is extremely large. It forms a frame which is nearly completely bony for a large tympanum; and below this frame it descends in form of an apophysis for the articulation of the lower jaw. This frame leads into a vast cavity, completed only at its upper posterior angle by the mastoidean. At the bottom of this cavity is a hole through which passes the ossiculum auditûs to arrive at a second cavity, formed externally by the bone of the tympanic cavity, on the internal side by the petrous bone and the occipital bones, below a little by the sphenoid bone, and closed backwards by cartilage. It is a second part of the tympanic cavity which is thus divided by a constriction, of which we have examples among the mammals, especially in the genus *Felis*, but the communication between the two parts is less narrowed than in the tortoise. The tympanic bône forms besides a considerable part of the posterior walls of the temporal fossa. Between it and the parietal the petrous bone shows itself in this same temporal fossa, and the cranium is closed behind by the occipital bone, which is here divided into six,—not into four bones; for the lateral occipitals are each divided into two parts, the most external of which Cuvier terms the exterior occipital. The fenestra ovalis is, he observes, common to the petrous bone and this exterior occipital; as, in the crocodile, it is common to the petrous bone and the ordinary lateral occipital: the fenestra rotunda, on the contrary, is pierced in the exterior occipital, as it is pierced in the lateral occipital of the crocodile. The two bones contribute to the formation of the cell of the labyrinth with the upper occipital, as the petrous bone and the lateral occipital contribute to it in the crocodile. In both genera the great aperture for the exit of the fifth pair of nerves is in front of the petrous bone, between it and the temporal ala. In the Turtle this hole is between the petrous bone and the descending part of the parietal bone. The ossiculum auditûs is simple, as in the crocodile, and formed of a slender stem which widens at the point of its approximation to the fenestra ovalis, and which is there applied by a round and concave surface, so that it has nearly the figure of a trumpet. The external end of the stem, placed in the external part of the cavity, is, in great part, cartilaginous, and terminated by a plate of the same substance and of lenticular form, which is encased in the membrane of the tympanum, and which may be considered as the analogue of the malleus. The Eustachian tube is entirely cartilaginous or membranous. It commences in the external chamber of the cavity, above, by a large notch of the posterior border of the tympanic bone, near the edge of the tympanum itself, and is directed obliquely within, passing between the bone of the cavity and the depressor muscle of the lower jaw, to a notch of the lateral and posterior border of the pterygoïd bone, whereby it penetrates into the back of the fauces, on the side, close to the articulation of the lower jaw, but far enough from its congener, and especially very far behind the internal nostrils. On the palate, or rather, behind the roof of the back of the mouth, may be seen the orifices of two tubes, under the form of two small holes separated from each other.

Reverting to the lower surface of the cranium, behind the maxillaries and the frontals, posterior to the two sides of the vomer, are the palatines, surrounded behind and externally by the pterygoïd bones, which last extend along the external border of the palatine to the maxillary bones. The rest of the pterygoïds covers the lower surface of the cranium between the two tympanic cavities and the two temporal alæ, leaving exposed to view behind only a triangular part of the body of the sphenoïd. Here, Cuvier observes, the palatines have only their upper portion, that is to say, that which, in the mammifers, separates the back nostrils from the orbits, and they want that recurved part which prolongs the roof of the palate behind the maxillaries: he adds that when he wrote he had found it impossible to discover the lachrymal bone in the tortoises, any more than in the seals and dolphins, though he had recognised a vestige of it in the whales, and he says that he does not see that Ulric or Bojanus had found it more than he had done, but he had observed towards the point of junction of the anterior frontal, the palatine, and the maxillary bones, an aperture which might well perform the functions of a lachrymal hole. The olfactory and optic nerves have their exit by the cartilaginous septa of the cranium, and not by any particular opening in the skull. Cuvier thinks that it is the same with the third and fourth pairs: the sixth goes forth by a small canal of the body of the sphenoïd bone. The fifth pair has a great hole between the petrous bone and the temporal ala divided into two externally. There is at the external border of the palatine bone a hole analogous to the pterygo-palatine.

Internally, the cerebral cavity is higher than it is wide; the bottom of it is very entire: but, in front, in the sphenoïd, there is a deep fosset for the pituitary gland, a kind of saddle. From the sides of this part spring the cartilaginous septa, which in going to form a junction with the ante-cerebral partition of the frontal bone, close the cavity of the cranium, support the whole anterior part of the encephalon, and occupy the place of the cribriform plate, of the orbital alæ; or otherwise, the anterior sphenoïd, and the greater part of the temporal alæ, of which another considerable part is replaced by the descending portions of the parietal, so that what remains does not participate in the formation of the chamber of the cranium except a little in front of the hole for the fifth pair of nerves. There is no more bony trace of the anterior sphenoïd than in the crocodile.

Cuvier observes that this description, taken from *Testudo Indica*, sufficiently agrees with the other *terrestrial tortoises* properly so called.

1



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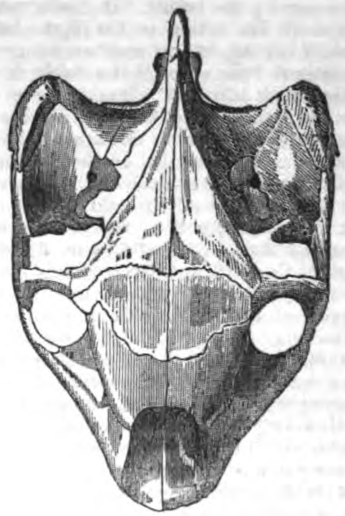

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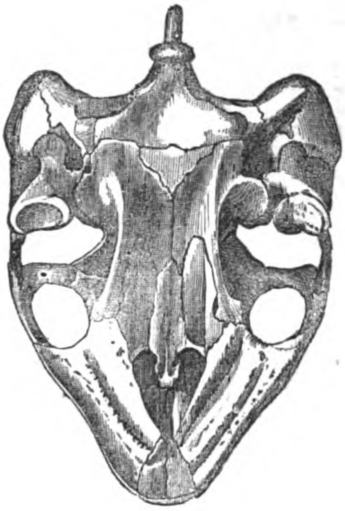

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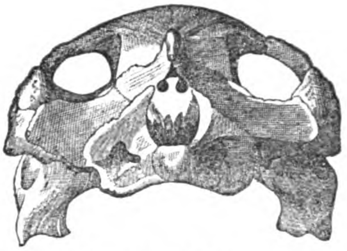

Skull of Testudo Indica.

1, profile; 2, seen from above; 3, seen from below; 4, seen from behind.

In the *Emydes*, or *ordinary fresh-water tortoises*, the same author remarks that the head is more flattened. The principal frontals, although they are wider than they are long, do not always reach to the border of the orbit, as is, for example, the case in the *Testudo* (*Cistudo*) *Europæa*; the posterior frontal is wider. The frame of the tympanum is not complete, and in lieu of a hole there is a fissure for the passage of the ossiculum auditûs from one hollow of the cavity to the other. The basilary and palatine regions form but one plane; the palatines not being even concave. Cuvier observes that *Testudines scripta*, *picta*, *scabra*, *dorsata*, *centrata*, *clausa*, and *virgulata*, belong to this category. Certain *Emydes*, he remarks, *Emys expansa* for instance, tend to the Sea-tortoises or Turtles and the fresh-water tortoises, and yet exhibit characters peculiar to themselves. The head is depressed, the muzzle short, and the orbits small and placed very forward. It wants the bony vomer, so that its two back nostrils form but one aperture in the skull. Its palatines want the palatine portion. The frame of the first chamber of its tympanic cavity is complete; this chamber communicates only by one narrow hole with the mastoïdean cellule, and the Eustachian tube takes its origin there by means of a slit, which is an extension of the hole by which the ossiculum passes into the second chamber. The temporal bone is covered, as in the turtles, by the parietal, temporal, jugal, and posterior frontal bones. This last is very narrow; it has one portion descending into the temple, which, uniting to an ascending part of the palatine bone and to a re-entering portion of the jugal bone, forms a partition which separates the orbit from the temporal fossa, not leaving any communication except one great hole near that descending part of the temporal bone which replaces the temporal ala. The pterygoïd unites itself forward with the palatine and jugal bones, and not with the maxillary, which does not reach so far backwards. Its external border is re-curved with the neighbouring portion of the jugal bone, and thus forms in the lower part of the temple a kind of canal, which takes its commencement at the hole of communication of the temple with the orbit. Its posterior angle on the contrary is directed a little downwards, descending more than the articular facet for the lower jaw, and leaving between it and the elevated part of the external border a wide notch. Between this angle and the articular facet is a fossa, hollowed in the tympanal, in the sphenoïd, and the pterygoïdean bones. The mastoïdean tubercles are depressed, very much projecting backwards, and pointed; their point is formed by the mastoïdean and the external occipital. On each side in front of the tympanic cavity the lower border of the skull has a wide notch cut in the temporal, the jugal, and the lower maxillary, as in the Land Tortoises. The sphenoid shows itself below on a surface much wider than in the Land Tortoises, and the basilary appears less. The lateral occipitals are also very small, and are promptly anchylosed with the basilary bone. The tubercle for the articulation with the atlas is less projecting than the mastoïdean apophyses. In the *Testudo* (*Emysaura**) *serpentina*, Cuvier no longer found at a certain age the external occipital distinct. It was united to the lateral occipital; whilst in the Land Tortoises it is to the upper occipital that it is, rather, united. The skull of the *Testudo serpentina* is, he observes, depressed anteriorly, the muzzle very short; the orbits moderate and approaching the muzzle; the temple covered only at its anterior part by a lamina of the parietal bone, less complete than in the turtles, and by an enlargement of the posterior frontal and of the jugal bones. The palatines have no palatine lamina; the palatine and pterygoïdean region is very flat. The analogous holes of the pterygo-palatines are very large. The passage of the ossiculum auditûs is made by a hole, and not by a fissure.

In the *Trionyces*, or Soft Tortoises, the skull, Cuvier observes, is depressed, and elongated backwards; the muzzle, pointed in certain species (that of the Nile, for instance), is short and rounded in some others. The intermaxillary bones are very small, and have neither nasal nor palatine apophysis; there is behind them a large incisive hole. The maxillaries unite upon the palate for a rather long space, so that the posterior nostrils are more backward than in the Land Tortoises. The palatines do not unite below to prolong the palate; they are hollowed into a demi-canal anteriorly, and less extended than in the Land Tortoises. The body of the sphenoïd reaches up to them, passing between two pterygoïdean bones, which do not unite, but extend from the lateral occipital, between the tympanic cavities and the basilary bone, and to the sides of the body of the sphenoïd to the palatines and maxillaries, a conformation which renders the whole of the basilary and palatine regions wide and flat. Above, the anterior frontals advance between the maxillaries and supply exactly by this part the place of the proper bones of the nose without any distinguishing suture; they even proceed to form a point on the external aperture of the nostrils, as the bones of the nose often do in the mammals. The principal frontals form nearly a square; they reach the border of the orbit. The jugal forms a part of the posterior and lower border of the orbit, and nearly the whole of the zygomatic arch, of which the squamous portion of the temporal bone forms only a small part in front of the tympanic cavity; this last has its frame complete. The ossiculum passes by means of a hole to enter the second chamber of the cavity, which, as in the other tortoises, is closed behind by a cartilage only. The Eustachian tube commences by a notch of the posterior border as in the Land Tortoises. The spine of the occiput and the mastoïdean tuberosities are all three pointed, and project more backwards than the articular condyle. The space occupied by the tympanic cavity at the posterior border of the temporal fossa is very narrow, but it widens in descending again towards its apophysis for the lower jaw. The temporal ala is placed below and in front of the great hole of the fifth pair of nerves, and the descending part of the parietal bone articulates itself in front of it to the internal pterygoïdean. It therefore enters more into the composition of the cranium, and is more easily recognised, than in the other tortoises.

Cuvier found no osseous trace of the anterior sphenoid, nor of its alæ; a rather delicate membrane occupies its place, and closes on each side the front of the cerebral cavity.

The principal character of the *Marine Tortoises*, or Turtles (*Chelonians* as they have been generally termed), is, Cuvier remarks, that a lamina of their parietal, their posterior frontal, their mastoïdean, their temporal, and their jugal, unite together, and with the tympanic cavity by sutures, to cover the whole region of the temple with a bony roof, which has no solution of continuity. Their muzzle being shorter than in other tortoises, and their orbits much longer, their nasal cavity is smaller, and as wide as it is high and long. Its posterior wall belongs entirely to the anterior frontals, and it is between them that the olfactory nerves are introduced. The bony tubes of the back nostrils commence in the lower part of this posterior partition, and, like the palatines, have a palatine part or lower lamina; these tubes are rather longer, more directed backwards, and bear less resemblance to simple holes. It results also from the size of the orbit that the inter-orbital membranous or cartilaginous space is more extended. The portion which Cuvier regards as the temporal ala is, he observes, singularly small in *Chelone Mydas*, entirely at the external surface, and simply resting on the suture of the descending part of the parietal and pterygoïdean bones. In *Chelone Caretta* and *Chelone Caouana* Cuvier could not find even a vestige of it. The ossiculum auditûs does not pass by means of a hole, but of a large notch from the first chamber of the tympanum into the second, and this second is cartilaginous throughout its posterior partition; it is by the same notch that the Eustachian tube descends towards the back of the mouth. The first chamber of the tympanum is slightly concave; there is no mastoïdean cellule so called; but the mastoïdean bone completes only the ceiling of this chamber, and thus extends its cavity. The hole of the fifth pair is oval and very large between the descending portion of the parietal, the pterygoïdean, and the petrous bone; for the rest, the skull of the species of *Chelone* resembles that of the preceding tortoises. Cuvier believed that he had discovered in one of the species (a young *Chelone Mydas*) a vestige of a suture that might separate a lachrymal bone from the orbital part of the maxillary bone: it was however only an indication scarcely so strong as that which marks the intermaxillary of man.

But, Cuvier observes, the most heteroclite skull among the tortoises is that of the *Matamata* (*Testudo fimbriata*). Extraordinarily large and flat, it seems, as he remarks, to have been crushed. The very small orbits are close to the end of the muzzle. The posterior region of the cranium is elevated; and the two tympanic bones, in form of trumpets, widen out on each side of the cranium. The temple is a wide horizontal fossa, not deep, and not at all covered, except behind by the union of the posterior angle of the parietal with the mastoïdean bone; and, what is peculiar, Cuvier observes, to this subgenus, this fossa is not framed in externally, because there is no temporal bone, or, at least, it is reduced to a simple vestige. The two maxillaries form together a transversal arch, in the middle of which, below, is a single intermaxillary, and, above, the external aperture of the nostrils, which is continued into a small fleshy proboscis. The two palatine bones, and, between them, the vomer, fill below the concavity of this arch, and have in front the two back nostrils well separated, but which the palatines do not encircle below. At the

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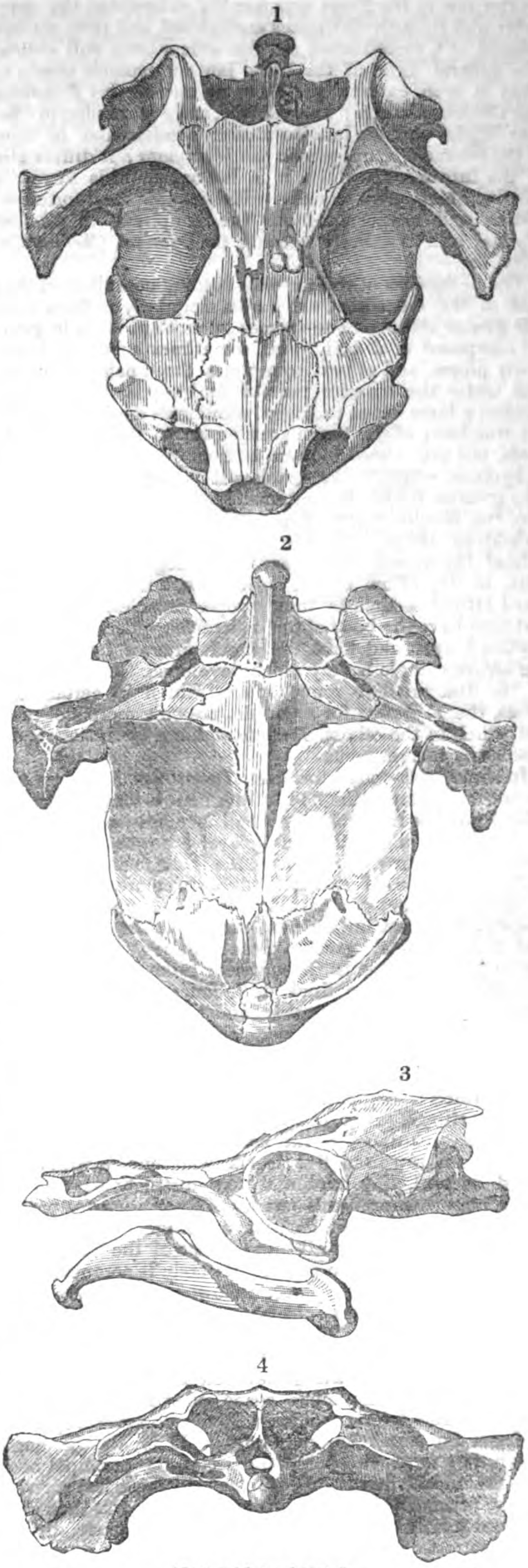
Chelydra serpentina, Schweigg, &c., *Chelonura* and *Emys* of other authors.

posterior border of the palatine is a rather large pterygo-palatine hole. The anterior and posterior frontals form the upper part of the orbits. The principal frontals advance between the anterior frontals to the edge of the external nostrils. There is no more nasal bone than in the other tortoises. The jugal proceeds from the posterior angle of the orbit between the maxillary and posterior frontal, beyond which it does not go, touching a little behind and below the pterygoïdean; but not forming any projection behind to border the temple. This last is in this manner separated from the orbit by a postorbital branch of excessive width, and which takes in the totality of the posterior frontal and the jugal bones. The posterior frontal articulates itself to the pterygoïdean by its external posterior angle. The rest of its posterior border is free, and is continued with that of the parietal to cover a wide and flat canal of communication, proceeding from the temple to the orbit, and formed below by the pterygoïdean and palatine bones. The two pterygoïdeans are enormous. They form the greatest part of the base of the cranium and of the bottom of the temple. Their external border is curved in its anterior part for its continuation with the free border of the posterior frontal: there are neither orbital nor temporal alæ. The parietal bones, which form above a great rectangle, unite by their descending portions to the palatines, the pterygoïdeans, the petrous, and the upper occipital bones. They form by themselves nearly the whole roof of the cranium. Following the pterygoïdean, the temple is bounded behind by the tympanic bone or the tympanic cavity, which resembles in part a trumpet. The frame of the tympanum is complete. A hole in the posterior wall suffers the ossiculum to pass into the second chamber, which, in the skull, is only a long groove of the posterior surface of the cavity, which terminates in a hollow, in the formation of which the petrous bone, the external occipital, and the lateral occipital concur. It is not closed behind, except by cartilage and membranes; and in the wall of the side of the cranium are pierced the two fenestræ, as ordinarily. Above this hole of the first chamber, by which the ossiculum passes, is another which conducts into the mastoïdean cellule, which, on account of the outward projection of the tympanum, is found within and not behind. The occipital spine is a short vertebral crest, and the mastoïdean tubercles are transversal crests, which belong entirely to the mastoïdean. Even in large individuals the six occipitals ordinary to the tortoises may be distinguished. Below, the smooth and nearly plane cranium presents a sort of regular compartment, formed of the intermaxillaries, the maxillaries, the vomer, the palatines, the pterygoïdeans, the sphenoid, the petrous bones, the tympanic cavities, the basilary, and the lateral and external occipitals. Behind the ceiling of the temple the petrous bone forms a square compartment between the pterygoïdean, the tympanic cavity, the external occipital, the superior occipital, and the parietal bones.

The *lower jaw* of the tortoises is divided in a manner which it is not very easy to refer to that manifested in the crocodile, to which, Cuvier observes, that of the birds has a much more striking relation; but the bird's jaw, he adds, also approaching to that of the tortoises, aids us in referring it to a common type. The space occupied in the crocodile by the two dental and the two opercular bones is filled in the marine tortoises, the fresh-water and land-tortoises, as well as in the *Trionyces*, with a single bone only, the analogue of the two dental bones. Cuvier never saw in all these subgenera, even in their youth, any trace of symphysis: the bone is continuous in the tortoises, as in birds. The *Matamata*, or *Chelys*, on the contrary, preserves in every age a division at the anterior part. The opercular bone always exists, as in the crocodile, at the internal surface; but it is carried farther backward, and attains to the posterior extremity. Beneath it is the angular bone forming the lower edge of the jaw. That which Cuvier names the surangular bone occupies the external surface of this part of the jaw, and proceeds also to its posterior extremity, but only touches the angular bone quite behind, and in becoming separated on the two anterior thirds by a long point of the dental bone. Above, and towards the back part, between the opercular and surangular bones, the articular bone is situated, as in the birds; but in the tortoises it is reduced to smaller dimensions, only serving for the articulation and for the insertion of the depressor muscle, or the analogue of the digastric muscle. The coronoid apophysis does not belong at all to the surangular bone in this order, but to a bone placed between the dental, the opercular, and the surangular bones; and in front of the aperture by which the nerves enter the jaw, an opening, which is here found at the upper border, instead of being, as in the crocodile and the birds, at the internal surface. This bone, which is not found in the birds, can only respond to the complementary bone in the crocodile,



Skull of Chelys fimbriata.

1, seen from above; 2, seen from below; 3, profile; 4, seen from behind.

Cuvier saw in the *Emys expansa* the surangular, the opercular, and the articular bones anchylosed, and their sutures effaced, at a period when all the others were still visible. The general form of the bony jaw corresponds nearly to what is seen externally. More pointed in the *Trionyces* and *Chelone Caretta;* more obtuse, more parabolic, in *Chelone Mydas* and the land-tortoises; semicircular in front of the coronoïd apophyses in the *Matamata;* it differs also in the furrow with which it is hollowed: this furrow is narrow, deep, and equally wide in the land-tortoises; widens and deepens towards the symphysis in *Chelone Mydas;* and is entirely wanting in *Trionyx*, *Chelone Caretta*, &c.

The *os hyoïdes* of the tortoises is more complicated than that of the crocodiles, and varies singularly in form from one genus, and even one species to another. It is in general composed of a body itself, sometimes subdivided into many pieces, and of two, sometimes three pairs of horns; and under the anterior part of its body is, besides, suspended a bone or a cartilage, sometimes double, which is the true bone of the tongue analogous to that seen in the birds, but articulated in them in front of the body of the os hyoïdes, whilst in the tortoises it is suspended below it. The greatest horns (the anterior pair when there are only two, the middle, when there are three, representing the styloïdean bones) embrace the œsophagus, and mount behind the muscles which are the analogues of the digastrics, or depressors of the lower jaw, but without being fixed otherwise than by their proper muscles. The land-tortoises have the body of the os hyoïdes wider, its anterior portion longer, and want the small anterior horns, whilst the anterior angle is very much developed. In the middle of the disk are two round spaces, which in certain tortoises, the *T. Indica* for example, are only more delicate; but which in the others, *Testudo radiata* for instance, are absolutely membranous.

In some fresh-water tortoises, *Testudines Europæa* and *clausa* for example, the body of the bone is longer than it is wide; and has in the front a small membranous space, and at its anterior angles the small lateral horns. Sometimes two or even four osseous nuclei are there formed.

The os hyoïdes of *Trionyx* differs still more. Its body is composed in front of a cartilaginous point, under which is suspended a great lingual oval cartilage. At the base of this a rhomboïdal osseous piece adheres on each side, which piece represents the anterior horns, and afterwards four others forming a thick disk, concave above, wider in front, and notched on the sides and behind. At the anterior angles of this disk adhere the middle horns, and to the posterior angles are attached the posterior horns: all four are very bony. The middle are formed by a long piece, which is compressed, arched, and terminated by a small cartilage. The others are wider, flatter, and prolonged by a cartilage, in the substance of which are encrusted in a row from five to six bony nuclei, which are round or oval, very hard and very distinct; so that the entire bone comprehends twenty different osseous pieces, which appear to remain distinct to old age.

The most singular of all these is that of the *Chelys*, and is very early entirely ossified. Its body is composed of a long, narrow, prismatic piece, hollowed above by a canal where the trachea runs. In front this piece is dilated, and carries on each side two angular portions, four in all, without counting the piece itself. The two intermediate ones unite in front, leaving between them and the principal body a membranous space on which the larynx reposes. The lateral portions, Cuvier observes, represent perhaps the small anterior horns. It is on the angle which they form with the dilatation of the principal body that the middle horns are articulated; these last are very strong, prismatic on their internal moiety, and then slender, and terminated by a bony and pointed piece, distinct from the rest of the horn. The posterior horns are articulated at the posterior extremity of the prism formed by the principal body. They are long, strong, slightly compressed, and curved into an arch.

Under the anterior and dilated part is suspended the true bone of the tongue, formed in front of a semicircular cartilage, and behind of two bony pieces in form of a crescent, the internal angle of which is prolonged into a sort of tail or pedicle, which lies under the prismatic body of the os hyoïdes.

In the Turtles (*Chelone Caretta* for instance) the body of the bone is in the form of an oblong buckler, concave above for the support of the larynx and the commencement of the trachea, and drawn out in front into a point which penetrates into the flesh of the tongue in passing upon the lingual bone. It presents on each side an angle for carrying the anterior horn, which is very small; the great horn curved into an obtuse angle for going round the œsophagus and jaw, more bony than all the rest of the apparatus, is articulated to the middle of the lateral border of the body of the bone, and its free or upper extremity is terminated by a small cartilaginous articulation. The posterior horns are articulated to the posterior angles. They are cartilaginous, flat, rather wide, and scarcely arched.

Bones of the trunk: dorsal buckler, or Carapace.—The wide differences prevalent in the modification and arrangement in the bones of the head in this order lead one to expect, as the great French zoologist observes, proportional differences in the rest of the skeleton. The cranial differences are, as he remarks, greater perhaps than obtain among the whole of the mammals, and most certainly are more extensive than can be found in the whole class of birds.

The general distinguishing character of the tortoises, that which separates them from all the *Vertebrata*, is the external position of the bones of the thorax, enveloping with a cuirass or double buckler the muscular portion of the frame, and serving also as a protection for the shoulder-bones and the pelvis.

The *dorsal buckler* is principally formed of eight pairs of ribs, united towards the middle by a longitudinal succession of angular plates, which adhere to the annular parts of so many vertebræ, or even form a part of them; but it is remarkable that these annular portions alternate with the body of the vertebræ and do not correspond directly with them.

The *ribs* are inlaid by means of sutures into these plates; they are also united with each other, on the whole or a part of their length, according to the species, and even in each species according to the ages of the individuals. There are eight anterior vertebræ which do not enter into this conjunction. The seven first (the ordinary cervical) are free in their movements. The eighth, which may be regarded as the first dorsal, is placed obliquely between the last cervical and the first of the fixed vertebræ of the dorsal buckler, which shortens it anteriorly; behind, its spinous apophysis is elongated, and enlarges a little to attach itself by synchondrosis to a tubercle of the first of the plates of the intermediate series of the plastron.

The first of these *fixed vertebræ*, which is the second dorsal, is still rather short, and carries also its proper annular part, the spinous apophysis of which, shorter than the preceding, attaches itself to the second plate by a cartilage. This second plate, narrower than the first, forms but one bone with an annular part which is below, and of which the anterior portion is articulated by two small apophyses with the articular apophyses of the second dorsal. This, properly speaking, is the annular portion of the third dorsal vertebra; but the body of this third vertebra is only articulated by its anterior moiety with the posterior moiety of this third annular part, and by its posterior moiety it is articulated to the anterior moiety of the fourth annular portion; and this alternative continues, so that the body of the fourth vertebra responds to the annular portions of the third and the fourth, the body of the fifth to the annular portions of the fourth and fifth, and so on to the tenth.

But it is necessary to distinguish in the ribs the plate included in the buckler, and a small branch which proceeds from its lower surface, and which represents what is termed the head of the bone in the ordinary ribs. This head is always articulated between two bodies of vertebræ. The first of all these ribs has only this small branch, without having any plate belonging to it in the buckler, excepting only in some of the *Emydes*, where may be seen, between the first and the second longitudinal plate, and the first or second widened rib, a small piece which can only represent the enlarged portion of this first rib, but which does not belong to its head. It is articulated between the eighth vertebra or first dorsal, and the first fixed vertebra, and by its other extremity applies itself to the internal surface of the second rib. This last has a plate which incorporates itself by its anterior border with the first of the longitudinal series, by its spinal border with the second piece of that series or the annular portion of the third vertebra, and by its head between the body of the second vertebra and that of the third. The succeeding ribs observe the same law, are articulated by means of their head between the body of one vertebra and that of the succeeding vertebra, and incorporate themselves by means of their dilated part with the plate which represents the annular portion of the second of these two vertebræ: and this, Cuvier observes, is a return to the general law; for in man and in the quadrupeds the ribs are articulated by their head between two vertebræ, and, by means of their tuberosity, with the transverse apophysis of the second of the two. The dilated portions of the ribs of the tortoise, in the part where they are incorporated with the plates of the longitudinal series, represent, then, the tuberosities of the ribs of mammals. The ninth plate of the longitudinal series, which belongs to the tenth dorsal, is the last with which a pair of the dilated ribs is incorporated, and this last is the ninth in all or the eighth of those which enter into the composition of the dorsal buckler. It is directed from its posterior border backwards, and embraces again the succeeding plates, with the external edges of which it becomes incorporated: but these three plates do not, any more than the first, serve to complete the vertebral canal.

The tenth rib, attached between the bodies of the tenth and eleventh vertebræ, produces no plate and enters not into the composition of the dorsal buckler. Like the first, it has only a portion of the head, and is joined by its other extremity to the internal surface of the ninth.

The eleventh vertebra after the cervical is the only one that can be termed lumbar; it carries no rib. In the Turtles, its annular portion again gives a plate to the longitudinal series of the dorsal buckler, and is the tenth and the smallest of the pieces of this series. The twelfth and thirteenth vertebræ are the sacral. At their sides are attached two lateral pieces sufficiently similar to the heads of the ribs, but stronger, especially the first, and convex at the end, in order to their union with the posterior and upper angle of the ossa ilii. Their annular portion is close and complete, and is not incorporated with the plates of the buckler which follow that of the eleventh vertebra. The vertebræ of the tail are free, like those of the neck: hence the plates of the longitudinal series, which follow the tenth, do not adhere to the vertebræ, and, if they belong thereto, only so belong by a metaphysical relation, and accordingly they may be considered as having been dismembered. So of the first of all the plates of the series. It only furnishes an attachment to the annular portion by synchondrosis, otherwise close and complete, of the first dorsal vertebra, and if one would regard it as belonging thereto, it would be necessary to consider it as dismembered.

The Turtles have three longitudinal plates after the tenth, making thirteen in all; but the second is sometimes divided into two, and the ninth also, which increases their number to fifteen.

Cuvier found fourteen in some of the *Emydes*, the *Emys serrata* for instance; but the eleventh and twelfth, he adds, are very small in them. There is but a single one after the tenth in the Land Tortoises and the *Chelydes*, so that they have only eleven in all. It sometimes happens that one or two of these plates are not seen externally. Thus in the Box Tortoises the two ribs of the last pair are joined to each other and thus cover the ninth plate; and in this respect many modifications occur in the same species; of which Bojanus has, in his third plate, given many examples taken from the European tortoise.

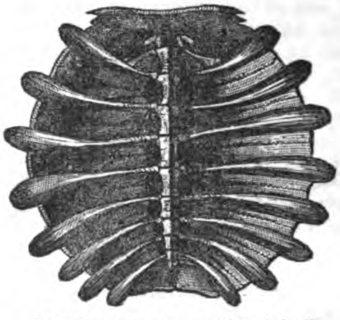
In *Chelys* the last and penultimate rib are attached to the eighth plate, and the ninth remains hidden. In both cases the tenth and the eleventh subsist as ordinarily.

In the Turtles, the eight pairs of ribs and the thirteen plates of the longitudinal series form a slightly convex oval buckler, a little narrowed backwards. The ribs are not incorporated throughout their length, a narrow fraction remains towards their exterior, and the intervals between this portion and that of the anterior and posterior ribs are filled up by a cartilaginous membrane only. It is only in extreme old age that some are widened to the end. Cuvier had sometimes seen the three first and a part of the fourth in this state.

In the freshwater Tortoises and in *Chelys*, the buckler is entirely filled up in time, and the ribs incorporate themselves throughout their length, between each otner and with the marginal pieces. The ossification proceeds still faster in the Land Tortoises, and it is only in their youth that vacant spaces are observed between the external parts of their ribs.

In the Museum of the Royal College of Surgeons in London, No. 131 of the *Physiological Series* is the carapace or dorsal shell of a very young Turtle (*Chelone Mydas*), showing the state of ossification, which is continued from the margins of the ribs, at this period quite distinct from each other, until they meet and become joined by indented sutures similar to those of the cranium.

The buckler is more or less convex according to the species, and various are the modifications which it undergoes: but our limits will not permit us to go further into details, for which we must refer the reader to Cuvier's work.



Carapace of Trionyx, seen from below.

The *sternum*, *plastron*, or *breast-plate* is always composed of nine pieces, of which eight are pairs, and the ninth is odd and always placed between the four anterior ones, with the two first of which it generally coheres, when it is not articulated with the four.

These nine pieces vary much in figure according to the genera and species.

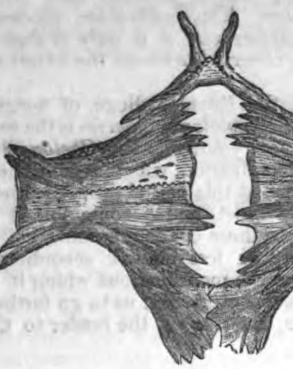
In the Land and Freshwater Tortoises and in *Chelys* they only leave vacancies between each other in early youth, when they are formed by bony rays shooting in various directions in the still cartilaginous disk of the plastron, like the bones of the cranium in the fœtus of mammals; but, with age, these rays join each other from every side, and form a disk compact in all its parts, which unites itself by a more or less considerable extent on each side to the dorsal buckler.

In the Turtles or Chelonians, and in the *Trionyces* or Soft Tortoises, these radiating expansions do not unite throughout; and even when the four pieces on each side unite together and the odd piece is joined to those of the first pair, there remains in the middle, between them all and on each side between them and the dorsal buckler, great spaces which are filled up by cartilage only.

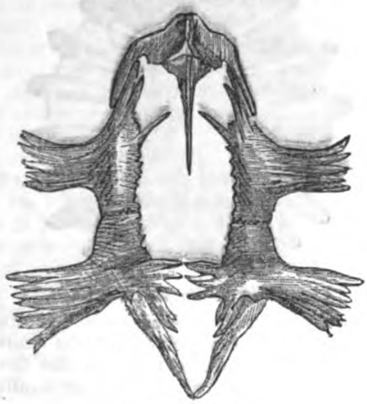
Again we must refer for the various modifications of the pieces of the breast-plate to Cuvier's work, and here give representations of one or two of them.

Vertebræ.—The *atlas* is composed of four pieces. The two first, united above in a slight spinous prominence, after having surrounded the vertebral canal, and each having given backward its articular apophysis, concur with a third very small one in the formation of a ring for the reception of the condyle of the head: Cuvier calls it a ring, because in the skeleton this fosset is open, and its bottom filled by a fourth piece, which is a true body of a vertebra without the annular portion, and which, presenting an anterior convex surface in the space here noticed, is articulated behind by a concave surface on the body of the axis. This piece, analogous to what we have already seen in the crocodile, represents, he observes, the odontoïd apophysis of the axis of mammals. At their junction, there is besides, attached below, a small bone formed nearly like a patella (rotule).

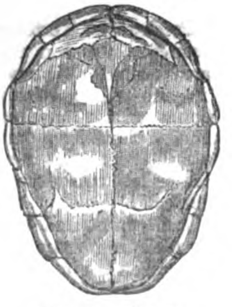
The axis and the succeeding vertebræ are composed of a nearly rectangular body, carinated below, concave in front, convex behind, and of an annular portion, which remains distinct from the body throughout life, by means of two sutures, is elevated above by a crest in lieu of a spinous apophysis, and whose anterior articular apophyses, placed at first under the posterior portions of the preceding vertebra, raise themselves obliquely to embrace them



Sternum of Trionyx.



Sternum of Chelone.



Sternum of Cistudo.

slightly up to the sixth, and nearly resume their horizontal position in the two succeeding ones. At the anterior angle of each side of the body is a small facet, common to the body and the annular portion.

The vertebræ adhering to the dorsal buckler have their body wide and feebly carinated in the marine and fresh-water tortoises: in these last it is even flattened in the anterior ones. It is also wide and with but little convexity in *Trionyx*, and *Chelys* has it wide and elevated longitudinally into a small crest. But there are land-tortoises (*Testudines geometrica* and *radiata*) in which it is excessively compressed, and does not even join itself throughout, except by a membranous partition, to the pieces of the middle row of the buckler, these pieces only affording each two narrow laminæ, and descending on each articulation of the two bodies. It is in a fold of the lower portion of this membrane, between these vertical laminæ, and in a semicanal hollowed at the upper part of the bodies, that the spinal marrow goes.

In the other subgenera the pieces of the longitudinal series of the dorsal buckler afford more complete vertical partitions, which form with the bodies a continuous bony canal, the nerves of which go out through holes which remain between the laminæ.

The sacral and caudal vertebræ are each composed of a body concave before and convex behind, of an annular portion, squarely flattened, and without a spine above, the anterior articular apophyses of which obliquely embrace below the posterior apophyses of the preceding vertebra, and of two transverse short apophyses, articulated on each side on the suture, which joins the body to the annular ring. Cuvier counted twenty-three caudal vertebræ in *Testudines Græca, Indica*, and other land-tortoises, and as many as twenty-seven in *Testudo radiata*. He states that there were only eighteen in the fresh-water and marine tortoises which he examined.

Bones of the Extremities.—Under the singular necessity, says Cuvier, which compelled nature to place the bones of the shoulder and pelvis within the trunk, and there attach the muscles, she seems to have made efforts to deviate as little as possible from her general plan.

The bone which goes from the dorsal buckler to the sternum is suspended by a ligament under the dilatation of the second rib, but in front of the first, which, as we have seen, consists only of a head articulated under the second; so that, in some respects, this bone is outside the thorax. There is sometimes in the ligament by which it is attached one, and even two, peculiar bones. Cuvier refers to the description and representation of one in the European Tortoise by Bojanus; and Cuvier himself found it also, but in the cartilaginous state. In an American Box Tortoise he observed two; but he satisfied himself that there were none in the great Land Tortoise, and he never saw any in those Marine Tortoises which he dissected. This bone is at first nearly cylindrical: it proceeds forwards, and after having afforded on its external surface a portion of the articular facet which receives the head of the humerus, it goes, with a more or less strong inward bend, to attach its other extremity to the internal surface of the sternum, towards the lateral angle of the odd piece. Cuvier saw in a very young Marine Tortoise this sternal branch divided by a suture, so that the portion of it which joined the sternum appeared a distinct bone; but, he observes, if this is general, it must unite to the other at a very early period; for he never found this suture in extremely young Land and Freshwater Tortoises. The rest of the facet for the articulation of the humerus is furnished by another bone, which is directed more or less obliquely backward and towards the mesial line, widening into a fan-shape, and which thus lies nearly parallel to the sternum. The osseous branch which comes from the bony buckler is, according to Cuvier's self-corrected opinion, the shoulder-blade, and the part which it offers beyond the articular fosset is its acromion. The flattened bone which is directed backwards is, he adds, incontestably the coracoïd bone: and he further remarks that all the muscles which proceed from these bones to go to the arm are respectively the same as in *birds*, whatever changes they have undergone in their position relatively to the horizon, in their size, and in their figure. Cuvier considers that it remains to be known whether there is a clavicle or not. If, he remarks, the suture which he had observed in a Marine Tortoise were constant, there would be no difficulty; one might make the clavicle of the sternal extremity of the bone which goes from the carapace to the sternum, which would be the more natural, inasmuch as it goes to attach itself to the odd piece (pièce impaire) of the sternum: but if this occurrence be merely an accident, then one must suppose that the clavicle is wanting, as in the crocodile, or seek for it in the anterior pair of the sternal pieces, the position of which is, in fact, relatively to the odd pieces, sufficiently like that of the clavicle of the SAURIANS and of the ORNITHORHYNCHUS.

This three-branched shoulder, this nearly cylindrical shoulder-blade, this acromial portion nearly equal in volume to the rest of the shoulder-blade, are, says Cuvier, characteristic of the Tortoises. There is nothing parallel to this conformation in the other animals, because there is no other shoulder situated within the thorax. The varied forms of these parts afford, Cuvier observes, very good characters for the subgenera; and he details the modifications characteristic of the Marine Tortoises, the Land Tortoises, the Freshwater Tortoises, *Chelys*, and *Trionyx*.

The *humerus* of the Tortoises is required, he remarks, to turn singularly upon its axis, in order to place the fore-foot in the position required by the bony cuirass, which only leaves a narrow passage for it. The result is that its internal tuberosity is become posterior and superior, and that the external tuberosity is become internal and also posterior. The head of the bone goes out of the axis more than in any other animal, and that towards the posterior face, which, in the ordinary position, is the superior one.

It presents the segment of a sphere, and is very convex. The two tuberosities are very large, very projecting, and leave, between, a concavity, as there is one, backwards, between the condyles of the humerus in the greater part of the Mammals. The internal tuberosity—become, as has been pointed out, posterior,—is the largest. It has the form of a long obtuse crest, analogous to the deltoidean, and which receives the same muscles. The other tuberosity forms a crest also, but much shorter. Both are near the head. The body of the bone is bent; and its concavity, which, in man, would be anterior, is ordinarily found inferior. The opposed surface is convex. Above it is a small hollow opposite the end of the fossa, which is between the two tuberosities. The lower part of the bone is widened, and a little flattened from before backwards. On the external border is a furrow, not much developed in the Land Tortoises; deeper in the *Emydes*, the *Chelydes*, and the *Trionyces;* and which, in the Marine Tortoises, nearly separates the lower head of the bone into two unequal parts. This furrow, Cuvier observes, is perhaps the best character for distinguishing the lower part of the humerus from that of the femur, which is without it, but which, in every other point, offers only very slight differences. Its lower head, transversely oblong and of uniform convexity, receives the bones of the fore-arm, but without offering two distinct facets.

The *Trionyces* do not differ from the Land Tortoises, excepting in having the tuberosities more apart. Other differences are manifested in *Emys* and *Chelys*, for which we refer to Cuvier's work, but the humerus of the Marine Tortoises cannot be passed by without particular notice, for it differs from that of all the other *Testudinata* in being not bent longitudinally, but nearly straight; in having its great tuberosity (the analogue of the small or internal tuberosity in man) longer, overreaching the head, and resembling an olecranon; and, lastly, in having the other tuberosity shorter, and representing a chevron-shaped crest.

There are always two bones in the *fore-arm*, but they have little motion one on the other. They are placed, when the animal progresses, so that the ulna forms the external and the radius the internal border of the arm.

The *radius* has a semicircular, slightly concave, upper head, a somewhat slender body, and the lower head compressed and cut, as it were, obliquely, so that it is shorter on the ulnar side.

The ulna is compressed. Its upper head is triangular and cut obliquely, so that its external border is longer upwards than the radial border, without having a true olecranon. This border is trenchant. The lower one is cut square. Differences occur, as in *Trionyx* and the *Chelonians* or Marine Tortoises.

The *pelvis* is always composed of three distinct bones, contributing, as in the quadrupeds, to the composition of the cotyloïd fossa, viz. an elongated *os ilium*, which attaches itself by ligaments to the transversal processes of the sacral vertebræ and the neighbouring part of the eighth pair of the dilated ribs; a *pubis* and an *ischium*, which are directed, widening as they proceed, towards the plastron, and are each united to its similar piece. At the point of union for the formation of the cotyloïd cavity, each bone has three faces; one for each of the two others, and one for the cavity. On the rest of the length the os ilii is oblong, the ischium proceeds, widening as it goes, directly towards the symphysis, and the pubis, after first directing itself forward, makes a curve towards the symphysis, and widens also to reach it. Various differences occur in this part of the skeleton in the Land and Marine Tortoises, in *Chelys* and in *Trionyx*.

The *femur* might be easily mistaken for the humerus of a mammiferous quadruped. Its oval head leaves the body of the bone, without being precisely separated from it, by a narrow neck. In lieu of the trochanter there is a transverse crest, but little elevated, separated from the head by a semicircular depression. The middle of the bone is delicate and round, and the lower part compressed from before backwards, widening by degrees to form the lower head, which is a transverse portion of the cylinder a little inflected backwards. Differences of modification occur in the Freshwater and Marine Tortoises. In the museum of the Royal College of Surgeons, No. 255 A, of the Physiological Series, exhibits the os innominatum and femur of a large Tortoise (*Testudo Indica*, Vosmaer). The hip-joint is laid open to show that the ligamentum teres is deficient, a simple form of joint which obtains at the hip in all the *Testudinata.*

The two bones of the *leg* are nearly straight. The *tibia* is larger and nearly semicircular above, becoming again slightly larger below; the *fibula* is more compressed and wider below. The first presents a slightly concave uniform surface, the other one which is slightly convex and rhomboidal at the astragalus. Modifications occur in the Land Tortoises, in *Chelys*, in *Trionyx*, and in the *Chelones*.

Bones of the Fore-foot.—The differences in the mode of progression required corresponding variations in the bones of the fore and hind feet especially. Accordingly we find that in the *Chelones* all the bones of the waist are flat and cut nearly square. In the first row are two bones adhering to the ulna, and in the last row five smaller ones, supporting the five bones of the metacarpus. There is besides an intermediate bone under the first ulnar bone, and upon the second and third of the last row. Cuvier observes that this would seem to correspond with that dismembered trapezoïdal bone which is found in the monkeys. Lastly, there is a great semi-lunar bone out of the rank, adhering to the external border of that which is above the metacarpal of the little finger. It is a true pisiform bone, although a little descended. Between that which is on the metacarpal of the thumb and the radius there is for a long time nothing but ligaments, and one does not see the great semilunar scaphoïdal which may be observed in the other subgenera: but with age, remarks Cuvier, a small radial bone shows itself in this place. Very large individuals have also the two penultimate bones of the second row anchylosed together. The metacarpal of the thumb is short and large: the others are long and slender. The little finger has two phalanges, and is not larger than the thumb; the three others are elongated, especially the middle finger; and the whole result is a pointed hand, which has the unguial phalanx of the thumb and forefinger only armed with a claw.

In the Land Tortoises there are but two phalanges on each finger, unless, Cuvier observes, one may suppose that there is wanting either the last row of the bones of the carpus, or that all the metacarpals are deficient, which is not admissible, because one may well see by the forms, and by comparison with the Freshwater Tortoises, that the metacarpals and those bones of the carpus do exist. This settled, there are found in the carpus a great radial or semilunar scaphoïdal, two ulnar bones nearly square, five bones of the second row supporting the five metacarpals, and an intermediate bone placed between the great radial, the first cubital or ulnar, and those which carry the third and fourth metacarpal. This intermediate bone, according to Cuvier, is often anchylosed with the semilunar scaphoïdal bone. The bones of the metacarpus are even shorter than the phalanges.

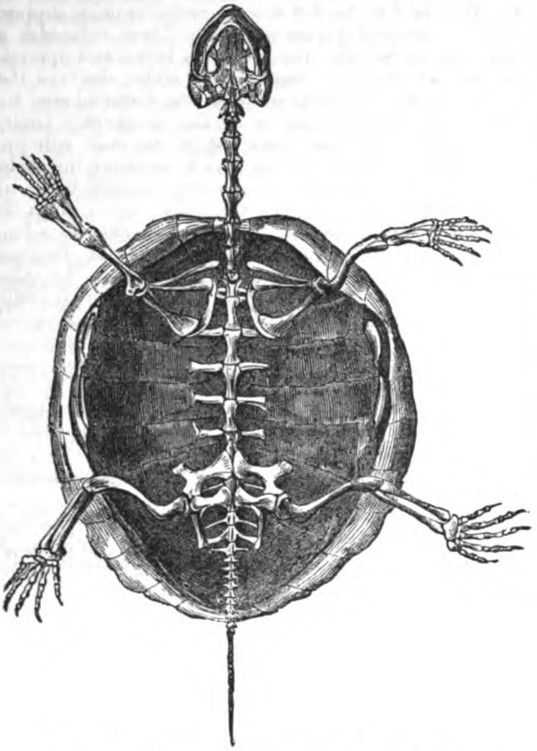
In the Freshwater Tortoises the three mesial fingers have their three phalanges well developed; but there are only two belonging to the thumb and the little finger. The metacarpals are rather long, and the two external ones are carried on a single bone of the carpus: nevertheless the last row consists also of five bones, because there is one, very small, externally on the side of the thumb. In the first row the ulna, in the European Tortoise at least, carries four bones—two large ones, a small intermediate one, and another small one out of the rank; but there are other species, *Testudo clausa*, for instance, where the two small ones do not appear. The great radial or semilunar scaphoïdal passes partially under the two ulnar bones.

The *Chelydes* have the hand formed nearly like the Freshwater Tortoises, except that their radial bone is small and re-enters towards the inside of the carpus at the side of the bone named by Cuvier intermediate; and that the little finger has, like the three intermediate ones, three phalanges.

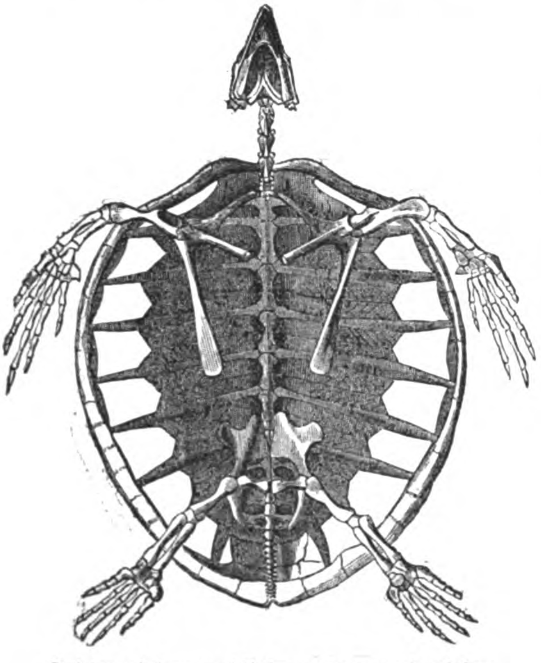
The *Trionyces* have also the radial bone re-entering at the side of the intermediate bone. Their three first fingers have their three phalanges large, wide, and pointed to carry the claws; the fourth has four phalanges, all rather slender; and the last three.

Hind-feet.—Cuvier remarks that in the *Testudinata*, generally, the calcaneum is without any backward prominence, so that their tarsus is flat like a carpus.

In the *Chelones* it is composed of six or seven bones, if the first of the little toe be counted: two in the first row, of which the largest, nearly rhomboidal and answering equally to the tibia and fibula, is the astragalus; the smaller, which is square and articulated only to the fibula, is the sole vestige of a calcaneum. In the second row there are four: three wedge-shaped for the metacarpals of the great toe and the two next toes, and one larger for the two last metatarsals. The bones of the metatarsus of the great and little toes are shorter than the others, and singularly wide and flat. That of the little toe, however, may be taken for one out of the rank of the tarsus. In this last case the little toe would have but two phalanges, otherwise three like the others. The great toe has but two. It carries a claw, and so does the next toe. The two succeeding toes have still their last phalanges rather large, although without claws, but the last has that phalanx very small.



Skeleton and Carapace of Cistudo vulgaris, seen from below.



Skeleton and Carapace of Chelone caouana, seen from below.

In the *Land Tortoises* the bone analogous to the astragalus is larger and thicker; and the fibular bone on the analogue of the heel is smaller. The four other bones exist, and that here called the metatarsal of the little toe seems to make up the suite by its position and figure. It sometimes carries a vestige of a toe formed of one piece, which seemed to Cuvier to be wanting in many species. The metatarsal of the great toe is very short and not flattened: the others are rather longer. None of the four existing toes has more than two phalanges.

The tarsus of the *Freshwater Tortoises* is nearly the same, except that the fibular ossicle, or calcaneum, when it is not united to the astragalus, is larger; that the ossicle which serves as a vestige of the little toe is longer, and that the three toes which succeed the great toe have their phalanges very distinct.

In the tarsus of the *Trionyces* the fibular bone descends outside the three cuneiform or wedge-shaped bones, and carries half the head of the third metatarsal and the whole of that of the fourth. At its external border a large square bone adheres, that about which Cuvier expressed a doubt whether it was a metatarsal bone or one out of the rank. It carries the fifth metatarsal on the first phalanx of the little toe; but in this case the little toe would have three. It is true, Cuvier adds, that the fourth toe has four, without counting its metatarsal. The great toe has two, and the two succeeding toes three each. In all three the last is large, wide, and pointed to carry a claw. In the fourth and fifth toe this last phalanx is very small and without a claw.

In the *Matamata* (*Chelys*) the fourth toe is, like the two preceding, composed of three phalanges and armed with a claw; the fifth also has three phalanges, and it would even have four if one regarded the bone as to which Cuvier has expressed his doubts as a tarsal bone; but the last is very small, cartilaginous, and without a nail. The tarsus is the same as in *Trionyx*, with this difference, that the analogues of the astragalus and the calcaneum are divided transversely each into two bones; so that what is detached from the calcaneum forms a fourth cuneiform bone for the fourth metatarsal, and that which is detached from the astragalus is a true scaphoïd, which carries the three first cuneiform bones.

Muscular system, particularly as relating to locomotion.—We have seen that the shoulder-blade is internal in the tortoises, that is, it is placed on the inside of the ribs: the muscles, consequently, of the head and neck, instead of being attached *upon* the ribs and spine, as in the other *vertebrata*, are attached *beneath* them: the same observation holds as to the bones of the pelvis and the muscles of the thigh, so that, to use Cuvier's expression, a tortoise may be termed, in this respect, *un animal retourné*, an animal turned inside out, or rather, so to speak, outside in.

The progressive motions to be accomplished by the bony and muscular apparatus of the tortoises are those of walking, and swimming or paddling.

The walk of a tortoise is proverbially slow, such as might be expected from a reptile whose limbs are so imperfectly developed. Short, and placed at a great distance from the centre, they form a sort of short crutches, calculated to drag the unwieldy body gradually along, and if the animal be turned on its back it becomes almost helpless. The feet are little better than stumps, the toes being only indicated externally by what may be termed a collection of hoofs, placed, as in the elephants, on the circumference of the apology for a foot, and which serve, so to speak, as a sort of grapplings to hold on the surface of the ground and drag the armed trunk onwards. We hardly need add that progression in a vertical direction is impossible; but many tortoises can burrow with some difficulty.

Nor is this slowness out of place: the preservation of the animal is provided for by the very strong bony carapace and plastron protecting the whole body, and only suffering the head, tail, and four feet to be protruded from its anterior and posterior part and its four angles: these protruded parts can be withdrawn into the shell upon the approach of danger, and the animal then rests secure in its portable arched castle, leaving the enemy to the helpless task of besieging a garrison that can remain for months without food. A large land tortoise can defy the whole animal world except man, from whom nothing is safe.

The most complete defence is made by the *Box Tortoises;* for in them the pieces which form the sternum are moveable, and may be compared to doors or hinged lids, which shut upon the carapace and thus form a sort of closed coffer in which the head, neck, tail, and feet, in short, the only exposed parts, can at will be enclosed far more securely than a snail in its shell.

But this slowness is confined to the Terrestrial Tortoises; for the aquatic species swim with great facility on or below the surface; and some, *Chelone* and *Sphargis* for instance, with rapidity. But the well-developed flipper that enables the Marine Tortoise to oar its way with swiftness, is even a worse organ for land progression than the clumsy foot of a Land Tortoise. Not but that they will shuffle back to the sea, which they have only occasion to leave in order to deposit their eggs, at a good pace, and they will deal heavy blows with their flippers to those who attempt to stop them (for they, as well as the Land Tortoises, are very strong), as those who have been foiled in turning turtles have known to their cost.

But however powerfully the muscles which act upon the head, tail, and extremities are developed in this order of reptiles, those of the abdomen, as might indeed be expected, have little extent, and those of the ribs, as might also be divined, are non-existent; for nature does nothing in vain: but the square muscle of the loins, whose principal office in mammals is to move the lumbar vertebræ, acts in the tortoises, which have those vertebræ fixed, in another direction, and is employed in drawing up the moveable os ilii; and the straight muscle (rectus abdominis) which extends from the pubis to the sternum, moves the whole haunch in the greater part of the *Testudinata*.

Digestive System.—The *Testudinata* have no teeth, though there are often a median groove and denticulated projections and hollows: but the mandibles are covered with a horny case, as in the birds. The *Chelydes* and the *Trionyces*, though they have the horny covering, have the mouth furnished with soft skin so as to form a kind of lips. The muscles that work the lower jaw, which is the only moveable one, are very powerful in many of the species, and the force with which the great Turtles and many other *Chelonians* grasp a solid body in their vice of a mouth is prodigious. The *Chelydes* are the only Testudinata which have the jaws flat and the gape of the mouth very wide.

The *food* with which the *Testudinata* have to deal is various, and there are modifications in the digestive organs accordingly. The *Chelones* and *Testudines* generally prefer a vegetable diet. The *Trionyces* and *Chelydes* prey upon fishes and small aquatic birds; and the *Emydes* attack the weaker animals, such as crustaceans, insects, worms, and mollusks.

These aliments are submitted in the *Terrestrial Tortoises* and in the *Chelonians* to the trenchant horny bill, well fitted to mince up vegetable fibre, assisted by the tongue, which draws the food into the mouth and the horny grooves and hollows of the jaws; the *Trionyces* and *Emydes* seize their living prey in their sharp-edged beaks and tear it to pieces with the cutting and pointed claws of their fore-feet: some of these dart out their head and long neck upon their prey from an ambush; or, stealing along like the *cats* till they come within reach, suddenly extend their destructive apparatus with unerring aim. The *Chelydes*, whose fleshy jaws are flat, swallow their prey whole, and in this respect, as well as in the general conformation of the head and the os hyoïdes, they resemble the *Toads* and especially the *Pipas*, like which they are obliged to be content with a victim of small dimensions suited to the calibre of their mouth, which is, in truth, sufficiently large. They are said never to seize their prey till they are satisfied by its motions that it is alive, for they never feed on carcasses.

The *tongue* of the Tortoises is fleshy, like that of the Parrots, and its nervous papillæ are very distinct. The *œsophagus* is short, and in the *Chelonians* is furnished internally with a number of close-set cartilaginous points, directed, so as to prevent the regurgitation of the food, towards the *stomach*, which has a transverse position. The *intestines* are long; the *cloaca* is situated beneath the tail, and rounded, and, internally, is found the orifice of canals which terminate in the cavity of the *peritoneum*. The *liver* is voluminous, forming two masses or lobes placed transversely below the heart and in front of the junction of the œsophagus with the stomach. The *pancreas* is a very large gland, and the spleen is rounded, median, and situated at a considerable distance from the liver. The chyle is translucid and aqueous in the *Chelonians*, but of a white and milky tint in those species which feed on animals.

In the Museum of the College of Surgeons, Nos. 459, 460, 461, and 461 A, are preparations showing the œsophagi of *Testudinata*. In No. 460 will be observed the peculiar pyramidal processes in the œsophagus of a Turtle (*Chelone Mydas*) pointing downwards to the stomach, so as to insure the deglutition of the slippery *fuci* and other marine vegetables on which the animal feeds, and to prevent the regurgitation of the food. Nos. 509, 510, 511, 512, 513, 514, 515, and 516 exhibit the stomachs of *Testudinata;* and among them the portion of the stomach of a Turtle, *Chelone Mydas*, shows the remarkably thick muscular coat adapted for compressing with great force the sea-weeds which constitute its food. Nos. 659 to 668, both inclusive, are preparations of intestines of *Testudinata*. No. 751 is the cloaca of a small male tortoise, laid open posteriorly and showing the rectum terminating not in the urinary bladder, but in the preputial or outer cavity: the aperture of communication is puckered up, and on the cut edges may be seen the sphincter muscle which surrounds it: a little below the fæcal orifice may be seen that of the genito-urinary cavity, which is of a transverse form: the two bristles which project from it have been passed through the ureters, immediately above whose orifices are situated those of the vasa deferentia: the allantoïd or urinary bladder opens into the fundus of the genito-urinary cavity. The common outer cavity is to be seen almost wholly occupied with the penis, which is grooved, and terminates in a complex glans commonly found in the Chelonian reptiles. No. 752 is the cloaca of a small female tortoise with the outer cavity laid open anteriorly to show the termination of the rectum at its fundus, and the semilunar fold of membrane which separates the fæcal from the genito-urinary orifice. The outer cavity is also laid open anteriorly, together with the cervix of the allantoïd bladder, to show the genito-urinary depression, and the relative positions of the terminal apertures of the ovaries and ureters: the former being indicated by black bristles; the latter, which are situated below them, by white ones. The common terminal outlet is left entire. No. 753 is the cloaca of a female Turtle (*Chelone Mydas*), with the rectum and common outer cavity laid open posteriorly, showing the place of their communication; immediately anterior to the fæcal orifice is the genito-urinary orifice, which is of a semilunar form. The allantoïd bladder and genito-urinary cavity have been laid open anteriorly, showing their communication with each other; and also the orifices by which the oviducts and ureters communicate with the genito-urinary cavity; black bristles are inserted into the former, and white ones into the latter tubes. The parts being injected, the difference between the vascularity of the lining membrane of the rectum and that of the cloaca is distinctly shown: the common external outlet is preserved entire, showing its transverse semilunar form. Nos. 813 to 815, both inclusive, show the duodenum, gall-bladder, and hepatic ducts of *Testudinata*. No. 778 A exhibits the pyloric end of the stomach, duodenum, pancreas, and spleen of a *Chelydra serpentina*. No. 830 shows a portion of the intestine, pylorus, pancreas, and spleen of a tortoise; and No. 831, the spleen of a Turtle with the veins injected, showing their ramification on its exterior, as on the kidney in the cat-tribe. (*Cat.*, vol. i.) See further next section.

The power of abstinence in this order of Reptiles is very great. MM. Duméril and Bibron state that they have seen a *Long-necked Emys* remain more than a year without food; and Redi kept Land Tortoises fasting for eighteen months.

Circulating System.—The heart in the Testudinata is composed of two auricles, and one ventricle with two unequal chambers which communicate together. The blood of the body enters into the right auricle and that of the lung into the left; but both these modifications of blood mingle more or less in passing by the ventricle. In the museum of the College of Surgeons, No. 888 (*Phys. Series*) is a young *Chelone Mydas* injected, and with the ventral parietes of the body removed to show the heart, which is composed of two distinct auricles and one ventricle, and is situated, as in the Frog, in the middle line of the body. The pericardium has been in great part removed; its serous layer is continued upon the fibrous layer from the apex of the heart, as well as from the great vessels at the base. No. 918 exhibits the liver, stomach, heart, and great vessels of the European fresh-water tortoise (*Emys Europæa*, Schœpf.). The two lobes of the liver are united by a very thin strip below the heart; and the left lobe, like the lobulus spigelii of mammals, is seen adapted to the lesser curvature of the stomach. The anterior part of the pericardium being removed, the form of the heart is shown. The ventricle is transversely oblong: the two auricles rest upon its basis posterior to the three arteries, which arise close together, and are united for some way from their origins by dense cellular membrane. The right and posterior artery gives off the carotid and brachial arteries, and its trunk is continued over the right bronchus to the posterior part of the abdomen: the middle vessel, as in the snake, winds over the left bronchus, and joins the opposite aorta in the abdomen. The left vessel is the pulmonary artery; its two branches communicate in the fœtus with the two aortæ by two ductus arteriosi, and afterwards are exclusively distributed to the lungs. The bronchial tubes, owing to the high division of the trachea, are of great length in the Tortoise. No. 919 exhibits the heart of a *Chelone Mydas*, with the auricles laid open to show the complete septum by which they are separated, and the loose cellular and reticulate muscular structure of their parietes, &c.; and No. 920 shows the ventricle of a *Testudo Indica* with its two chambers of small size compared with the bulk of the ventricle. Nos. 956 to 962 A, both inclusive, are preparations of the arteries of *Testudinata;* and Nos. 965 to 973, both inclusive, preparations of the veins of individuals of the same order. No. 23 exhibits the coagulated blood of a turtle.

Respiratory System.—Cuvier remarks that the quantity of respiration in Reptiles is not fixed, like that of Mammals and Birds, but varies with the proportion of the diameter of the pulmonary artery compared with that of the aorta. Thus, he observes, the Tortoises and the Lizards respire much more than the Frogs.

The *lungs* are of great extent and placed in the same cavity with the abdominal viscera. We have seen that the thorax is immoveable, in the greater number at least, and the inlaid fixed ribs can give no assistance in respiration in the full-grown normal forms. It is therefore by the play of the parts about the mouth that the *Testudinata* respire, and here the complicated os hyoïdes is called into prominent action. The jaws are closed and the animal alternately elevates and depresses the os hyoïdes; the first movement lets the air enter by the nostrils, and the tongue then closing their interior aperture, the second movement compels the air to penetrate into the lungs. In short the *Testudinata* swallow or gulp down the air necessary for their respiration like the FROGS.

John Hunter, in his *MS. Catalogue*, observes that the vessels of the lungs of those animals whose whole blood passes through them are confined to the lungs, and lungs only, as distinctly as if the lungs were a separate animal; but this, he adds, is not the case with the *Amphibia*, 'for,' says he, 'we find the vessels of the lungs of the Turtle communicate with those of other parts, such as the vessels of the œsophagus, which shows that the blood of that part is not so perfect in them as in others. From this it must appear that the lungs are not of that consequence in this class of animals that they are in the more perfect, for the lungs themselves appear to share in common with the other parts. Some of the blood which just came from the lungs returns back again to them, which would appear to answer no purpose; and, on the other hand, a considerable quantity of the blood which had undergone the general circulation (and therefore would appear to require refinement) just returns through the same course. It would appear from this admixture, that it was not necessary that the whole of the blood should have undergone a thorough change for its greatest motion; yet we do not see why the lungs should have a part of their blood of the perfect kind. The cells of the lungs of the *Amphibia* seem to increase in size, the farther from the trunk or trachea, so that the trachea and its ramifications bear no proportion between them and the cells.'

No. 1109 A in the College Museum is a longitudinal section of one of the lungs of a *Chelydra serpentina* prepared by Professor Owen. This presents a further stage in the complication of the lung beyond what is observed in the *Saurians*. The general cavity is divided into eight compartments, and the vascular respiratory surface is consequently increased. The subdivision of the parietes into cells is greatest at the upper or superior part of the lung, and its ligamentous structure is continued over the margins of all the larger cells. Nos. 1110 to 1117, both inclusive, are also preparations of the lungs of *Testudinata*. No. 1110 shows the ventral parietes of the body of a young *Chelone Caretta* removed, exhibiting the lungs *in situ*, which extend over all the back part of the abdomen down to the pelvis.

Brain, Nervous System, and Senses.—In the *Testudinata* the vertical height of the capacity of the cranium is greater than in the other reptiles; but in the Sea Tortoises or Turtles the mass of the encephalon does not entirely fill it, and the highly vaulted bones are rather destined to serve as solid points of resistance to the upper beak, and to the powerful action of the muscles which act upon the lower jaw. The mass of the encephalon is less elongated and more compact than in the serpents. Bojanus, in his work on the anatomy of the European *Emys*, has shown that the great sympathetic or ganglionic series of nerves exists in that reptile nearly as it does in the other *Vertebrata;* that on the one hand it has sympathetic relations with the encephalic and vertebral nerves, and that on the other it makes a communication between the two lateral and symmetrical parts of the body, at the same time that its filaments are distributed and intermingle in numerous plexuses round the principal arteries destined to the nutrition of the internal viscera. Elaborate illustrations of the Nervous System, and especially of the great Sympathetic of the Hawksbill Turtle, have been published by Mr. Swan, in his 'Comparative Anatomy of the Nerves,' 4to., 1836.

No. 1312 in the Museum of the College of Surgeons is the brain of a *Chelonia Mydas*. The dura mater with one half of the arachnoïd membrane has been removed, and the vessels of the pia mater minutely injected. The partial removal of the arachnoïd shows how loosely it envelops the brain, and at the same time displays the form and disposition of the cerebral organs. The hemispheres of the cerebrum exhibit a higher development than in fishes, and are the largest of the encephalic masses; but their structure is extremely simple and their surface smooth. The olfactory nerves, by which the specimen is suspended, are continued from the anterior and inferior part of the hemispheres, and are bulbous at their commencement; they are formed by three roots, of which the inferior ones are most distinct. The optic lobes, or bigeminal bodies, are two spherical bodies, as in fishes, not divided into four by a transverse fissure, as in mammals. They are on a plane inferior to the cerebrum and cerebellum, but occupy a space between these parts uncovered by either. The optic nerves form a swelling at their commissure, beyond which they are continued for a short distance parallel to one another. A bristle is inserted into the infundibulum behind the commissure. In the angle between the hemispheres and optic lobes the pineal gland is continued upwards; it is hollow, and a bristle is placed in its cavity, which communicates with the fourth ventricle. The cerebellum is of an elongated form, without lateral lobes, and presents a simple and smooth exterior. It extends over the anterior part only of the fourth ventricle, which is consequently left uncovered posteriorly, except by membrane: a bristle is placed in that cavity. The medulla oblongata is without a pons Varolii. The origins of the several cerebral nerves are shown, and the sixth, eighth, and ninth pairs are distinguished by dark threads being tied round them. The origin of the nervus accessorius and its recurrent course to join the nervus vagus are very clearly displayed. Another brain, and of a large *Chelone Mydas*, is exhibited dissected in No. 1313. The preparation No. 1314 is the brain of another Turtle with both dura mater and arachnoid removed, and the cavities or ventricles of the cerebellum, bigeminal bodies, and cerebral hemispheres laid open; John Hunter thus describes it: 'In the first or superior ventricle is an eminence which extends a little way into the olfactory nerve, and runs through the whole length of the ventricle. The plexus choroïdes is also seen in the ventricle. The ventricle of the nates is exposed, and a white bristle is placed in it: as is the ventricle of the cerebellum, with a black bristle lying in it. At the lower part of the ventricle is a continuation of the tunica arachnoïdes, which shuts up or makes part of the ventricle. In the angle or quadrangle made by the cerebrum and nates, &c. is a duct or canal like the infundibulum leading from the upper part of the skull to the last ventricle.' Professor Owen observes that the canal here described is the cavity of the body which occupies the place of the pineal gland, and which is shown entire in the preceding specimen. The bodies termed nates, he adds, are recorded by Cuvier as the optic thalami; but since the publication of the works of Arsaki, Serres, and Desmoulins, their analogy to the bigeminal bodies or optic lobes of mammalia has been generally admitted.

No. 249 of the same series is a longitudinal and vertical section of the cervical vertebræ of a tortoise, in which the motions of the neck are much freer than in the Turtle; the articular surfaces of the bodies of the vertebræ being covered by cartilage, and surrounded by synovial membrane. The anterior surfaces of the first three vertebræ are convex, the posterior concave. The fourth vertebra, which is the principal centre of motion in the neck, has both the articular surfaces convex. Of the remainder the anterior surfaces are concave, the posterior convex. The canal of the spinal chord may be observed to be the widest where the motion in this part of the spine is most extensive.

Here we must notice the experiments of Redi, which were perhaps more cruel in appearance than in reality. Most are familiar with the length of time that a turtle will move after its head is off, and the snap of the jaws which the severed head will give; but there is reason for believing that there is more of irritability than sensation in such motions; and the state of Redi's tortoises must have been analogous.

Redi, in the beginning of November, made a large opening in the skull of a Land Tortoise, extracted the brain, and cleaned out the cavity. He then set the animal at liberty, and it groped its way freely about wherever it pleased, as if it had not been injured. Redi makes use of the term groping (brancolando), because he says that when the tortoise was deprived of its brain, it closed its eyes, which it never again opened. The wound which was left open skinned over in three days, and the tortoise, continuing to go about and execute other movements, lived to the middle of May. On a post mortem examination the cavity which the brain had occupied was found empty and clean, with the exception of a small, dry, and black clot of blood. He repeated this experiment upon many other Land Tortoises in the months of November, January, February, and March, with this difference, that some were locomotive at their pleasure, whilst others, though they made other motions, did not move about: he found the same results when he treated Freshwater Tortoises in the same manner, but they did not live so long as the terrestrial species. He states his belief that the Marine Tortoises would live a long time without their brain, for he received a turtle which he treated in the same way, and though it was much spent and faint from having been long out of the sea, it lived six days. In November he deprived a large tortoise of its head, without which it continued to live twenty-three days: it did not move about as those did whose brain had been taken out, but when its fore or hind legs were pricked or poked, it drew them up with great strength, and executed many other movements. To assure himself beyond all doubt, that life, such as it was, continued in such cases, he cut off the heads of four other tortoises, and on opening two, twelve days afterwards, he saw the heart beat and the blood enter and leave it.

We have already had occasion to call attention to the great length of time during which these reptiles will live without food, and the facts above recorded afford additional proof of the extreme tenacity of life—a low grade of life, it is true—in the *Testudinata*.

Touch.—In the greater part of this order skin, properly so called, does not exist at all on certain parts of the body, or is reduced to a delicate fibrous plate applied like a simple periosteum on the bones of the head and on the external parts of the vertebræ of the back, the ribs, and sternum. The soft tortoises (*Trionyx* and *Sphargis*, for instance) are the only ones that differ in this respect. Nevertheless the neck, the feet, and most frequently a considerable part of the tail, are covered with a true flexible skin. This skin in the *Matamata* is fringed or furnished with moveable appendages on the lateral parts of the head and neck. There can be no doubt that the sort of touch or sensation which will indicate to a *Trionyx*, or even to a Marine or Land Tortoise, the differences of temperature that affect the medium wherein it moves, is present in those animals, but the sensibility of a true touch must be very much blunted in them. Some have their toes united down to the nails, or rather hoofs, and absolutely immoveable; others have them flattened and forming a sort of paddle, as in *Chelone* and *Sphargis;* or the whole foot terminates by a sort of shapeless stump, rounded like that of the elephant, the presence of the toes being only indicated by those nails or hoofs, as in the Land Tortoises. Others, it is true, *Emys*, *Trionyx*, and *Chelys*, for example, have their toes very distinct, but they are nevertheless united by membranes, and in general their feet seem more adapted for the different modes of transport than for touch. The *Matamata*, indeed, has its nose prolonged into a sort of moveable proboscis; but this organization seems to be directed more to favour the required mode of respiration, than to give the animal that sort of perception exercised by the snout of swine and the muzzles of moles and some shrews. (Dum. and Bibr.)

Taste.—The wide fleshy tongue, with its distinct papillæ, like those of Mammals, seems well calculated for tasting vegetable and animal juices after the food is minced up by the horny mandibles; the fleshy lips on the outside of these mandibles in the *Trionyces* probably assist in retaining these juices. The Matamata, which from the width of its gape and unarmed mouth is supposed to swallow its prey whole, may yet have time while it is pressed in the jaws, previous to deglutition, to enjoy its flavour. In the museum of the College of Surgeons, Nos. 1459 to 1463, inclusive, afford instructive preparations of the os hyoïdes, tongue, larynx, part of the trachea, and fauces, in some of which, No. 1461 for instance, the tongue will be seen to be remarkably beset with numerous elongated papillæ, and the sublingual follicles carefully dissected.

Smell.—Though there is probably sufficient of this sense to assist the animal in its discrimination of food, and aid the functions of the tongue in giving the animal a perception of flavour, it may be concluded from the very simple state of the organs, so different from the complication of those in animals where the sense is known to be highly developed, that it is not very acute in the tortoises. Nos. 1532 to 1535, both inclusive, are preparations giving very good information respecting the state of these organs in the *Testudinata*. In No. 1532 the fibres of the olfactory nerve are seen expanding upon the turbinated cartilage.

Hearing.—In the *Chelonians*, *Emydes*, and *Testudines* is found, under the solid scales with which the lateral and posterior parts of their head are furnished, a portion of loose cellular tissue which fills a bony canal. In the middle of this substance is found a more or less bony plate, the external termination of a single ossicle prolonged into a slender stylet, into the interior of the cavity, where it enlarges anew, to close the foramen ovale, or opening of the canal which leads to the internal ear, and is called the vestibule. In all the other tortoises the cavity of the tympanum communicates very freely with the throat or back of the mouth, and in the interior of the ear, which is often contained in a cartilage-like substance, the three semicircular canals come to the common vestibule after they have each attained a slight increase of convexity. There is also a sort of rudiment of a cochlea. All these internal parts do not contain air, but a viscous albuminous liquid, and it is there that the last ramifications of the acoustic nerve, the soft portion of the auditory, terminate. (Dum. and Bibr.) The parts employed in this sense, which must be tolerably quick in the *Testudinata*, are well shown in Nos. 1578, 1579, and 1580 of the preparations in the museum of the College of Surgeons: in the case of the turtle, the drum, which is strong and thick, hangs suspended by the long ossicle.

Sight.—The eye is well developed in the *Testudinata*, and is large. It is modified so as to be adapted to the medium, whether air or water, through which the light is to be transmitted. In the substance of the cornea scales or osseous plates are found analogous to those in BIRDS [vol. iv., p. 428], and there are three eyelids and two lachrymal glands.

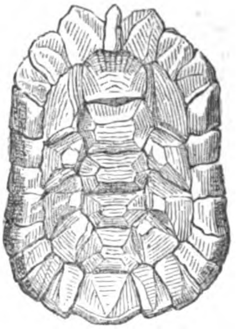
In the museum of the College of Surgeons, No. 1674 is the eye of a turtle (*Chelone Mydas*) transversely divided. The short ciliary arteries are injected, and form a beautiful plexus round the optic nerve; the nerve makes a conical projection at its entrance into the cavity of the eye. The choroïd is thick and of a brown colour, the posterior part of the iris and ciliary circle, from which the area appears to have been removed, are of a lighter colour. The ciliary plicæ are neatly defined, but, as in fishes, do not project forward as distinct processes. The iris and pupil are round. The sclerotica is cartilaginous, and is of unequal thickness, this being greatest at the posterior part, where it is also thicker at the temporal than at the nasal side of the globe; anteriorly it contains a circle of small bony plates. The cornea is circular and flat; No. 1675 is a similar preparation. No. 1676 is a portion of the eye of a turtle injected, showing the continuation of the optic nerve into the retina. No. 1676 A exhibits the vitreous and crystalline humours of the eye of a turtle; the lens is almost spherical, but slightly flattened anteriorly. No. 1766 is a preparation of the eyeball, eyelids, and lachrymal glands of a *Chelone Mydas*. The upper and lower eyelids are distinctly developed, and accurately close the conjunctival cavity when moved by their appropriate muscles. There is also a well-developed nictitating or third eyelid, which is situated vertically at the inner canthus of the eye, and has a horizontal motion over the cornea; it is slit across to show the orifice of the Harderian gland, of which the secretion is expressly destined to facilitate its movements. This gland however is of small size compared with the true lachrymal gland, which consists of the thick and broad conglomerate mass surrounding the outer and upper parts of the eyeball; its duct is short and wide, and terminates just above the external canthus of the eye; a portion of quill is inserted into it; a bristle is passed into the duct of the Harderian gland. The insertions of the muscles of the globe are here preserved; and the four small accessory muscles forming the suspensorius or retrahens oculi, and surrounding the optic nerve, deserve especial notice. No. 1767 shows the eyelids, with the Harderian and a portion of the lachrymal gland of a turtle. The nictitating membrane is entire, and a portion of the nictitator muscle is seen attached to its inferior angle. A bristle is placed in the duct of the Harderian gland, which opens on the internal surface of the nictitating membrane, near the line of reflection of the conjunctive membrane. The under eyelid, which has most motion, may be observed to have the fewest scales upon its external surface. No. 1768 is another preparation of the three eyelids of a turtle. (*Cat*, vol. iii.)

Generative and Urinary Systems.—Preparations illustrative of the generative and urinary male organs in the *Testudinata* will be found in Nos. 2441 to 2452 of the Museum of the College of Surgeons, both inclusive: in the last the bifid allantoïd bladder is distended with horsehair. The testes, which resemble the kidneys in shape and equal them in size, are distinguished by their smooth, white, unconvoluted surface. The large penis has been injected, and a small bougie is placed in the urethral groove: the glans penis, which bounds the urethral groove anteriorly, presents a crescentic figure, and projects from the under surface of the fibrous corpus cavernosum, which terminates in a point projecting beyond the glans.

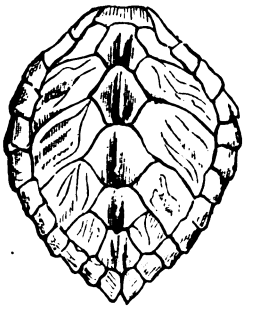
The female generative and urinary organs in several species are exhibited in Nos. 2718 to 2723, both inclusive, of the same museum. Nos. 1183, 1192, 1193, and 1194 are preparations of the kidneys of *Testudinata*.

According to the accounts of voyagers the Coriaceous Tortoises (*Sphargis*) and the *Trionyces* seem to pair, and two individuals of different sexes remain constantly together in the same places. The great Marine Tortoises, as is well known, come every year, at their appointed times, to deposit their eggs in the sand on the shores of the sea and banks of rivers near strands of gentle declivity. There the females hollow out a sort of rude but strong vaulted nest or oven, as it may be termed, wherein the eggs may have the benefit of the concentrated rays of the sun, so as to enjoy an equable heat, as in the case of eggs under a sitting hen, but under circumstances which do not permit the body of the mother to impart the necessary warmth. The shell of these eggs is generally solid, and their form globular, or of a short cylindrical shape equally rounded at the extremities. A female Turtle will lay as many as a hundred at one time. The plastron of the males of many species of *Testudinata* is concave, that of the female being convex, whereby the abdomen is rendered more capacious. The time employed in the coitus is very long. MM. Duméril and Bibron say that it has been seen to be prolonged in the Chelonians and Anurous Batrachians from eighteen to thirty-one days and more, before the male has quitted the female.

With regard to the integument of the carapace and plastron, the number, colour, and shape of the investing plates of horn or shell, as it is termed, vary considerably. The subjoined cuts will convey a better notion than words of their arrangement in a land and marine species; but it must be considered that these are mere examples, and that the variety is almost infinite.



Carapace of Testudo marginata, covered with shell.



Carapace of Chelone Caouana, covered with shell.

Systematic Arrangement and Natural History.

The general arrangement of the *Testudinata* will be found in the article Reptiles, so that we shall here have only occasion to notice the details of some of the principal systematists.

Aristotle has mentioned three principal groups of Tortoises, or at any rate genera, under the names of *χελώνη χερσαία* (Chelone chersæa) for the Land Tortoise; *χελώνη θαλαττία* (Chelone Thalattia, or Thalassia) for the Sea Tortoise or Turtle (*Hist. Anim.*, ii. 17); and ἑμυς (Emys) for the Freshwater Tortoise (*Ibid.*, v. 33). Gesner remarks that there are three 'summa genera' of Tortoises: the 1st, terrestrial; the 2nd, living in fresh waters; and the 3rd, in the waters of the sea. MM. Duméril and Bibron copy his 'Corallarium de Testudinibus in genere,' to show how far it accords with their own arrangement, as follows:—

Testudo aut est
- terrestris
- aquatica, aut in
  - mari
    - Testudo marina, *χελώνη θαλαττία.*
    - Mus marinus, *μὺς θαλαττιος.*
  - aquâ dulci
    - puriore, ut lacubus, amnibus.
    - cænosâ, ut paludibus.

Linnæus placed the form at the head of his *Amphibia Reptilia*, under the generic name *Testudo*.

Cuvier divides them into five subgenera—1, the Land Tortoises (*Testudo*, Brongn.); 2, the Freshwater Tortoises (*Emys*, Brongn.), including the Box Tortoises (*Terrapene* Merrem; *Kinosternon*, Spix; *Cistuda*, Fleming); 3, the Marine Tortoises; 4, the Chelydes (*Testudo fimbriata*); 5 the Soft Tortoises (*Trionyx*, Geoff.).

Mr. Bell (*Zool. Journ.*, vol. iii.), whose labours on this branch of natural history are deservedly praised by MM. Duméril and Bibron, thus arranges the order:—

Testudinata.

A. *Digitata.*

Family 1.—Testudinidæ. (Terrestrial. Herbivorous.)

Genera.—*Testudo*, Auct. *Pyxis*, Bell. *Kinixys*, Bell.

Family 2.—Emydidæ. (Fluviatile or lacustrine. Carnivorous.)

a. With a moveable sternum.

Genera.—*Terrapene*, Merrem. *Sternothærus*, Bell. *Kinosternon*, Spix.

b. With an immoveable sternum.

Genera.—*Hydraspis*, Bell. *Emys*, Brongn. *Chelonura*, Fleming. *Chelys*, Duméril.

Family 3.—Trionychidæ. (Fluviatile. Carnivorous.)

Genus.—*Trionyx*, Geoff.

B. *Pinnata.*

Family 4.—Sphargidæ. (Marine. Herbivorous.)

Genus.—*Sphargis*, Merrem.

Family 5.—Cheloniadæ.

· Genus.—*Chelonia*, Brongn.

The Prince of Canino, in his *Amphibia Europæa* (*Memorie della Reale Accademia delle Scienze di Torino*, serie ii., tom. ii.), makes the *Testudinata* the second section of his first subclass, *Ablopnoa*. The *Chelonii* form the fourth order of that section, and the *Chelonidæ* the fifth family, the *Trionycidæ* the sixth, and the *Testudinidæ* the seventh.

Chelonidæ.

Subfamily 6. *Chelonina.*

Genus 1.—*Chelonia*. Species, *Chelonia Mydas*.

Genus 2.—*Caretta*. Species, *Caretta imbricata*. (Hawk's-bill Turtle.)

Genus 3.—*Thalassochelys*. Species, *Thalassochelys caretta*. (Logger-head Turtle.)

Subfamily 7. *Sphargidina.*

Genus 4.—*Sphargis*. Species, *Sphargis coriacea*.

Testudinidæ.

Subfamily 11. *Emydina.*

Genus 5.—*Terrapene*. Species, *Terrapene Caspica*; *Terrapene Sigriz*.

Genus 6.—*Emys*. Species, *Emys lutaria*, Merrem.

Subfamily 12. *Testudinina.*

Genus 7.—*Testudo*. Species, *Testudo Græca*.

Genus 8.—*Chersus*. Species, *Chersus Iberus*; *Chersus marginatus*.

N.B. The arrangement stands thus in the 'Specierum Synopsis;' but in the 'Tabula Analytica,' '*Monopnoa*' is the name given to the first subclass.

Mr. Swainson (*Classification of Reptiles*, 1840) gives the following as the list of genera:—

1. Testudinidæ. Land Tortoises.

Genus.—*Testudo:* with the subgenera, *Testudo*, Linn.; *Chersina*, Merrem, Gray; *Hæmopus* (*Homopus* must be meant), Dum. and Bibr.; *Pyxis*, Bell; *Kinixys*, Bell.

2. Emydæ. River or Emys Tortoises.

Cistuda, Gray—printed in Italics, which is the sign in this work of a subgenus. Then comes *Emys*, Brongn., printed as a genus, and so is the next, *Kinosternon*, Spix, with the subgenera *Sternothærus*, Bell; *Chelodina*, Fitz.; *Hydraspis*, Bell.

3. *Trionycidæ*, Gray. Soft Tortoises.

Genus.—*Trionyx*, Geoff., with the subgenus *Emyda*, Gray.

4. Chelonidæ, Gray. Turtles, or Sea Tortoises.

Genera:—*Chelonia*, Gray. *Sphargis*, Merrem.

5. Chelydridæ, Swainson. Long-tailed or Crocodile Tortoises.

Genera:—*Chelys*, Duméril. *Platysternon*, Gray. *Chelydra*, Schweigg.

Mr. Gray (*Synopsis of the Contents of the British Museum*, 1840) makes the *Chelonia*, the third order of Reptiles in his arrangement, come under his second section, *Cataphracta*, the *Squamata* being the first.

Family 1. Testudinidæ.

Genera:—*Testudo*. *Chersina*. *Kinixys*. *Pyxis*.

Family 2. Emydæ.

Genera:—*Geoemyda*. *Emys*. *Cyclemys*. *Malaclemys*. *Cistuda*. *Kinosternon*. *Staurotypus*. *Chelydra*. *Platysternum*.

Family 3. Chelydæ.

Genera:—*Sternothærus*. *Chelodina*. *Hydraspis*. *Chelys*.

Family 4. Trionycidæ.

Genera:—*Trionyx*. *Emyda*.

Family 5. Cheloniadæ.

Genera:—*Sphargis*. *Chelonia*.

MM. Duméril and Bibron, in their elaborate and highly valuable *Erpétologie*, divide the Tortoises, or Chelonians, into the following families:—1st, The *Chersites*, Chersians, or *Land-Tortoises;* 2nd, The *Elodites*, Elodians, or *Marsh-Tortoises;* 3rd, The *Potamites*, Potamians, or *River-Tortoises;* 4th, The *Thalassites*, Thalassians, *Sea-Tortoises* or *Turtles*.

Of these groups the authors observe that *Chersites* is not perfectly limited, for some of the species arranged by them under the succeeding family (*Elodites*) seem to form a natural passage between the Land and Marsh Tortoises. Such are *Cistudo Carolina* and *Emys Muhlenburgii*, which are in reality *Paludines*, or Marsh-Tortoises, with distinct toes, though they possess only very short membranes and but slightly palmated feet.

The principal characters which distinguish the *Chersites* or *Chersians* from the three other divisions of the order *Chelonians* are thus defined:—Body short, oval, convex, covered with a carapace and a plastron; four feet; no teeth. But MM. Duméril and Bibron remark that the principal distinction may be enunciated by this simple term drawn from the conformation of the limbs, and which indicates perfectly the manner of life of the group—*stumpy feet* (des pattes en moignon):—this would recall the condition of those feet, namely, that they are short, unshapely, though nearly of equal length, with toes but little distinct, nearly equal, immoveable, united by a thick skin, and conglomerated into a sort of truncated mass, callous in its periphery, on the outside of which one only distinguishes horny cases, a sort of hoofs which, for the most part, correspond with the last phalanges they incase, and would consequently show that these animals live only on the land, never in the water. The other three groups differ from the last and from each other in the form of the feet.

The *Thalassites*, or *Thalassians*, have the carapace very much depressed, and their two pairs of feet, unequal in length, are flattened into the form of oars or solid fins, because their toes are always conjoined and hardly distinct from each other, incased as they are in these paddles.

The *Elodites*, or *Elodians*, have the toes separate, or rather separately moveable, furnished with crooked claws, most frequently palmated or united at their base by membranes, nearly as in the Ducks; but the transition of these last three families is, so to speak, insensible on the one side between the species of the genus *Cistudo*, and on the other between *Chelys* and all the species generally known as *Soft Tortoises*.

These last, the *Potamites*, or Potamians, have also the toes palmated or connected by membranes; they have pointed claws, three in number only, on each foot; their pointed and trenchant beak is constantly furnished externally with folds of the skin, like lips, appendages which have hitherto been only observed in this family. In addition their bony carapace is covered with a coriaceous skin, the edges of which in the greater number remain flexible and floating on the sides of the body.

1st Family, Chersians—Land-Tortoises.

Family Character.—Chelonians, with a very convex carapace; limbs short, equal; feet in the form of rounded, callous stumps, with indistinct unguiculate toes.

Carapace.	Moveable behind, where it is, as it were, articulated			4, Kinixys.
	Immoveable; nails on the anterior feet	four only		2, Homopus.
		five: front of the plastron	moveable	3, Pyxis.
			immoveable	1, Testudo.

Genus, *Testudo.*

Characters.—Feet with five toes, hind-feet with four nails only; carapace of a single piece; sternum not moveable anteriorly.

This genus is divided by MM. Duméril and Bibron into three sections, or subgenera:—

1. Those species which have the posterior portion of their plastron moveable: these correspond with the genera *Chersus*, of Wagler; *Testudo*, of authors; *Chersina*, of Gray.

2. Those species whose plastron is solid in all its parts, or of a single piece covered with twelve plates.

3. Those species which have the sternum equally immoveable, but covered with eleven horny plates.

These sections embrace twenty-two species.

In the first section *Testudo marginata*, Schœpf., and *Testudo Mauritianica*, Dum. and Bibr., are placed.

In the second are *Testudo Græca*, Linn.; *Testudo geometrica*, Linn.; *Testudo actinodes*, Bell; *Testudo pardalis*, Bell; *Testudo sulcata*, Miller; *Testudo nigrita*, Dum. and Bibr.; *Testudo radiata*, Shaw; *Testudo tabulata*, Walbaum; *Testudo carbonaria*, Spix; *Testudo Polyphemus*, Daud.; *Testudo Schweiggeri*, Gray; *Testudo elephantina*, Dum. and Bibr.; *Testudo nigra*, Quoy and Gaim.; *Testudo gigantea*, Schweigg.; *Testudo Daudinii*, Dum. and Bibr.; *Testudo Perraultii*, Dum. and Bibr.

In the third are, *Testudo angulata*, Dum. and Bibr.; *Testudo Graii*, Dum. and Bibr.; *Testudo peltastes*, Dum. and Bibr.; and *Testudo Vosmaeri*, Fitzing.

For an account of the habits of Land-Tortoises we turn to the records of two acute and eloquent observers, whose narratives it would be unjust to give in other words than their own.

White of Selborne thus writes to the Honourable Daines Barrington, from Ringmer, near Lewes, in October, 1770:—'A land-tortoise, which has been kept for thirty years in a little walled court belonging to the same house where I am now visiting, retires under ground about the middle of November, and comes forth again about the middle of April. When it first appears in the spring it discovers very little inclination towards food, but in the height of summer grows voracious; and then as the summer declines, its appetite declines; so that for the last six weeks in autumn it hardly eats at all. Milky plants, such as lettuces, dandelions, sow-thistles, are its favourite dish. In a neighbouring village one was kept, till by tradition it was supposed to be a hundred years old—an instance of vast longevity in such a poor reptile.'

Again in April, 1772, White writes to the same correspondent:—'While I was in Sussex last autumn, my residence was at the village near Lewes, whence I had formerly the pleasure of writing to you. On the 1st of November I remarked that the old tortoise formerly mentioned began first to dig the ground in order to the forming its hybernaculum, which it had fixed on just beside a great tuft of hepaticas. It scrapes out the ground with its fore-feet, and throws it up over its back with its hind; but the motion of its legs is ridiculously slow, little exceeding the hour-hand of a clock; and suitable to the composure of an animal said to be a whole month in performing one feat of copulation. Nothing can be more assiduous than this creature night and day in scooping the earth and forcing its great body into the cavity; but as the noons of that season proved unusually warm and sunny, it was continually interrupted, and called forth by the heat in the middle of the day; and though I continued there till the 13th of November, yet the work remained unfinished. Harsher weather and frosty mornings would have quickened its operations. No part of its behaviour ever struck me more than the extreme timidity it always expresses with regard to rain; and though it has a shell that would secure it against a loaded cart, yet does it discover as much solicitude about rain as a lady dressed in all her best attire, shuffling away on the first sprinklings, and running its head up in a corner. If attended to, it becomes an excellent weather-glass; for as sure as it walks elate, and as it were on tiptoe, feeding with great earnestness in the morning, so sure will it rain before night. It is totally a diurnal animal, and never pretends to stir after it becomes dark. The tortoise, like other reptiles, has an arbitrary stomach as well as lungs, and can refrain from eating as well as breathing for a great part of the year. When first awakened it eats nothing; nor again in the autumn before it retires: through the height of the summer it feeds voraciously, devouring all the food that comes in its way. I was much taken with its sagacity in discerning those that do it kind offices; for as soon as the good old lady comes in sight who has waited on it for more than thirty years, it hobbles towards its benefactress with awkward alacrity, but remains inattentive to strangers. Thus not only "the ox knoweth his owner, and the ass his master's crib," but the most abject reptile and torpid of beings distinguishes the hand that feeds it, and is touched with the feelings of gratitude.' In a postscript he adds, that in about three days after he left Sussex the tortoise retired into the ground under the hepaticas.

In April, 1780, White again writes to Mr. Barrington: 'The old tortoise that I have mentioned to you so often is become my property. I dug it out of its winter dormitory in March last, when it was enough awakened to express its resentment by hissing; and, packing it in a box with earth, carried it eighty miles in post-chaises. The rattle and hurry of the journey so perfectly roused it, that when I turned it out on a border, it walked twice down to the bottom of my garden; however, in the evening, the weather being cold, it buried itself in the loose mould and continues still concealed. As it will be under my eye, I shall now have an opportunity of enlarging my observations on its mode of life and propensities, and perceive already that, towards the time of coming forth, it opens a breathing-place in the ground near its head, requiring, I conclude, a freer respiration as it becomes more alive. This creature not only goes under the earth from the middle of November to the middle of April, but sleeps great part of the summer; for it goes to bed in the longest days at four in the afternoon, and often does not stir in the morning till late. Besides, it retires to rest for every shower, and does not move at all in wet days. When one reflects on the state of this strange being, it is a matter of wonder to find that Providence should bestow such a profusion of days, such a seeming waste of longevity, on a reptile that appears to relish it so little as to squander more than two-thirds of its existence in a joyless stupor, and be lost to all sensation for months together in the profoundest of slumbers.

'While I was writing this letter, a moist and warm afternoon, with the thermometer at 50°, brought forth troops of shell-snails; and, at the same juncture, the tortoise heaved up the mould and put out its head; and the next morning came forth, as it were raised from the dead; and walked about till four in the afternoon. This was a curious coincidence! a very amusing occurrence! to see such a similarity of feeling between the two φερεοικοι—for so the Greeks call the shell-snail and the tortoise.'

Again White reverts to the 'old family tortoise' in the same letter:—'Because we call this creature an abject reptile, we are too apt to undervalue his abilities and depreciate his powers of instinct. Yet he is, as Mr. Pope says of his lord,

"—— much too wise to walk into a well;"

and has so much discernment as not to fall down an haha, but to stop and withdraw from the brink with the readiest precaution. Though he loves warm weather, he avoids the hot sun; because this thick shell, when once heated, would, as the poet says of solid armour, "scald with safety." He therefore spends the more sultry hours under the umbrella of a large cabbage leaf, or amidst the waving forests of an asparagus-bed. But as he avoids heat in the summer, so, in the decline of the year, he improves the faint autumnal beams, by getting within the reflection of a fruit-wall; and, though he never has read that planes inclining to the horizon receive a greater share of warmth, he inclines his shell by tilting it against the wall, to collect and admit every feeble ray. Pitiable seems the condition of this poor embarrassed reptile: to be cased in a suit of ponderous armour, which he cannot lay aside; to be imprisoned, as it were, within his own shell, must preclude, we should suppose, all activity and disposition for enterprise. Yet there is a season of the year (usually the beginning of June) when his exertions are remarkable. He then walks on tiptoe, and is stirring by five in the morning; and, traversing the garden, explores every wicket and interstice in the fences, through which he will escape, if possible; and often has eluded the care of the gardener, and wandered to some distant field. The motives that impel him to undertake these rambles seem to be of the amorous kind; his fancy then becomes intent on sexual attachments, which transport him beyond his usual gravity, and induce him to forget for a time his ordinary solemn deportment.'

Mr. Darwin in his *Journal* describes the habits of *Testudo Indica*, or rather one of the species that have been confounded under that name, and, not improbably, the *Testudo nigra* of Quoy and Gaimard. He speaks of their numbers as being very great, as indeed they always seem to have been, for he quotes Dampier, who states that they are so numerous, that five or six hundred men might subsist on them for several months without any other sort of provisions, and describes them as being so extraordinarily large and fat, that no pullet eats more pleasantly. The day on which Mr. Darwin visited the little craters in the Galapagos Archipelago was glowing hot, and the scrambling over the rough surface, and through the intricate thickets, was very fatiguing. 'But,' says Mr. Darwin, 'I was well repaid by the Cyclopian scene. In my walk I met two large tortoises, each of which must have weighed at least two hundred pounds. One was eating a piece of cactus, and when I approached, it looked at me and then quietly walked away; the other gave a deep hiss and drew in his head. These huge reptiles, surrounded by the black lava, the leafless shrubs, and large cacti, appeared to my fancy like some antediluvian animals.'

Mr. Darwin states his belief that these tortoises are found in all the islands of the Archipelago; certainly in the greater number, and thus continues his description:—'They frequent, in preference, the high damp parts, but likewise inhabit the lower and arid districts. Some individuals grow to an immense size. Mr. Lawson, an Englishman, who had, at the time of our visit, charge of the colony, told us that he had seen several so large that it required six or eight men to lift them from the ground, and that some had afforded as much as two hundred pounds of meat. The old males are the largest, the females rarely growing to so great a size. The male can readily be distinguished from the female by the greater length of its tail. The tortoises which live on those islands where there is no water, or in the lower and arid parts of the others, chiefly feed on the succulent cactus. Those which frequent the higher and damp regions eat the leaves of various trees, a kind of berry (called guayavita) which is acid and austere, and likewise a pale green filamentous lichen, that hangs in tresses from the boughs of the trees.

'The tortoise is very fond of water, drinking large quantities, and wallowing in the mud. The larger islands alone possess springs, and these are always situated towards the central parts, and at a considerable elevation. The tortoises, therefore, which frequent the lower districts when thirsty, are obliged to travel from a long distance. Hence, broad and well-beaten paths radiate off in every direction from the wells even down to the sea-coast; and the Spaniards, by following them up, first discovered the watering-places. When I landed at Chatham Island, I could not imagine what animal travelled so methodically along the well-chosen tracks. Near the springs it was a curious spectacle to behold many of these great monsters; one set eagerly travelling onwards with outstretched necks, and another set returning, after having drunk their fill. When the tortoise arrives at the spring, quite regardless of any spectator, it buries its head in the water above its eyes, and greedily swallows great mouthfuls, at the rate of about ten in a minute. The inhabitants say that each animal stays three or four days in the neighbourhood of the water, and then returns to the lower country; but they differed in their accounts respecting the frequency of these visits. The animal probably regulates them according to the nature of the food which it has consumed. It is however certain that tortoises can subsist even on those islands where there is no other water than what falls during a few rainy days in the year.

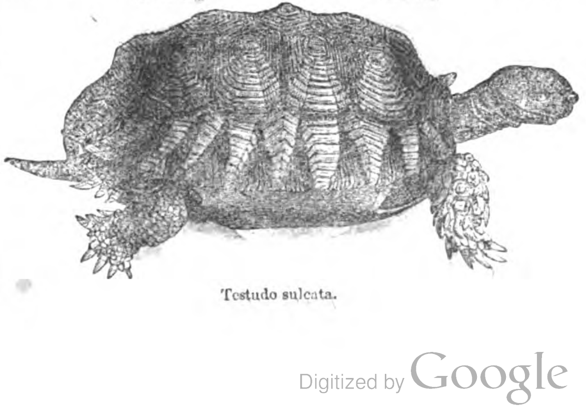
'I believe it is well ascertained that the bladder of the frog acts as a reservoir for the moisture necessary to its existence: such seems to be the case with the tortoise. For some time after a visit to the springs, the urinary bladder of these animals is distended with fluid, which is said gradually to decrease in volume and to become less pure. The inhabitants, when walking in the lower district, and overcome with thirst, often take advantage of this circumstance, by killing a tortoise, and if the bladder is full, drinking its contents. In one I saw killed, the fluid was quite limpid, and had only a *very slightly* bitter taste. The inhabitants however always drink first the water in the pericardium, which is described as being best. The tortoises, when moving towards any definite point, travel by night and by day, and arrive at their journey's end much sooner than would be expected. The inhabitants, from observations on marked individuals, consider that they can move a distance of about eight miles in two or three days. One large tortoise which I watched, I found walked at the rate of sixty yards in ten minutes, that is, 360 in the hour, or four miles a day—allowing also a little time for it to eat on the road. During the breeding season, when the male and female are together, the male utters a hoarse roar or bellowing, which, it is said, can be heard at the distance of more than a hundred yards. The female never uses her voice, and the male only at such times; so that when the people hear this noise, they know the two are together. They were at this time (October) laying their eggs. The female, where the soil is sandy, deposits them together, and covers them up with sand; but where the ground is rocky, she drops them indiscriminately in any hollow. Mr. Bynoe found seven placed in a line in a fissure. The egg is white and spherical; one which I measured was seven inches and three-eighths in circumference. The young animals, as soon as they are hatched, fall a prey in great numbers to the buzzard with the habits of the caracara. The old ones seem generally to die from accidents, as from falling down precipices. At least several of the inhabitants told me they had never found one dead without some such apparent cause. The inhabitants believe that these animals, are absolutely deaf; certainly they do not overhear a person walking close behind them. I was always amused, when overtaking one of these great monsters as it was quietly pacing along, to see how suddenly, the instant I passed, it would draw in its head and legs, and uttering a deep hiss fall to the ground with a heavy sound, as if struck dead. I frequently got on their backs, and then, upon giving a few raps on the hinder part of the shell, they would rise up and walk away; but I found it very difficult to keep my balance. The flesh of this animal is largely employed, both fresh and salted; and a beautifully clear oil is prepared from the fat. When a tortoise is caught, the man makes a slit in the skin near its tail, so as to see inside its body, whether the fat under the dorsal plate is thick. If it is not, the animal is liberated; and it is said to recover soon from this strange operation. In order to secure the tortoises, it is not sufficient to turn them like turtle, for they are often able to regain their upright position.

'It was confidently asserted that the tortoises coming from different islands in the Archipelago were slightly different in form; and that in certain islands they attained a larger average size than in others. Mr. Lawson maintained that he could at once tell from which island any one was brought. Unfortunately, the specimens which came hôme in the Beagle were too small to institute any certain comparison. This tortoise, which goes by the name of *Testudo Indicus*, is at present found in many parts of the world. It is the opinion of Mr. Bell, and some others who have studied reptiles, that it is not improbable that they all originally came from this Archipelago. When it is known how long these islands have been frequented by the buccaniers, and that they constantly took away numbers of these animals alive, it seems very probable that they should have distributed them in different parts of the world. If this tortoise does not originally come from these islands, it is a remarkable anomaly; inasmuch as nearly all the other land inhabitants seem to have their birthplace here.'

Geographical Distribution of the Species of Testudo.—The last-quoted observation of Mr. Darwin is worthy of much attention.

MM. Duméril and Bibron, who, to prevent the confusion hitherto arising from the application of the specific name *Indica* to more than one species, have eliminated that name altogether, give the following as the localities of the species of *Testudo*, so far as they are known:—Asia, 5; Europe, 3; common to Europe and Africa, 1; Africa, 7; common to Africa and America, 1?; America, 6.

Testudo sulcata will serve for an illustration of this genus: it is the species assigned to Africa and America with a ?. M. d'Orbigny is stated to have himself collected



Testudo sulcata.

the young of *Testudo sulcata* in Patagonia, where, according to him, the species is very common. MM. Duméril and Bibron declare that other specimens come without doubt from Africa.

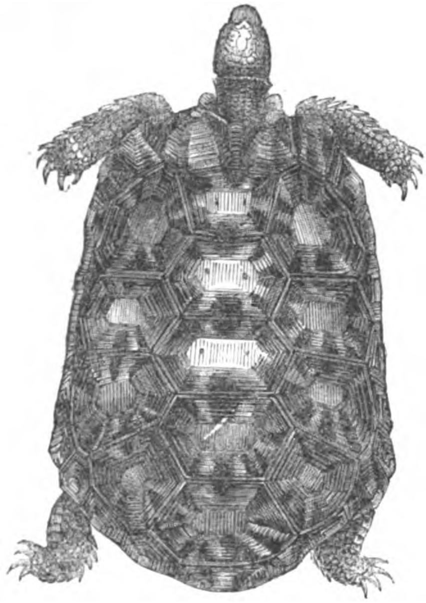
Genus *Homopus*, Dum. and Bibr. *Characters.*—Four toes only on each foot, and all unguiculate; carapace and sternum of a single piece.

Species, *Homopus areolatus* (South Africa, Madagascar); *Homopus signatus* (South Africa).

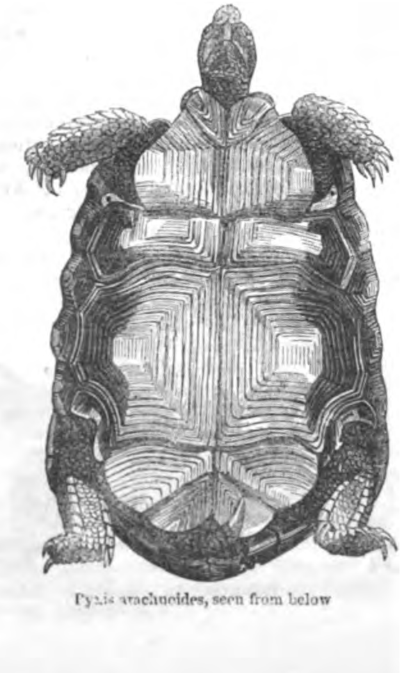
Genus *Pyxis*, Bell. *Characters.*—Feet each with five toes, the posterior ones with four nails only; carapace of a single piece; sternum moveable anteriorly.

This genus is the only Land Box Tortoise; but an analogue (*Sternothærus*) occurs among the Marsh Tortoises in the division of *Pleurodere Elodians.*

The anterior portion of the plastron of *Pyxis*, which is susceptible of motion, is of very small extent, for it only reaches, backward, to the space of the two first pairs of sternal plates, and consequently it is under the strongly indicated suture of the second with the third pair that the elastic ligament which performs the office of a hinge is seen. By means of this sort of moveable door or lid, the Pyxis can, by lowering it at will, protrude its head and its fore-feet, and by raising it, shut itself up in a sort of box, for the edges of this hinged operculum closely fit those of the carapace, which serve it as a door-case. The animal then has nothing to fear, because its sternum protects behind, by its enlargement, the space by which the feet and the tail can be put forth and deeply drawn up.



Pyxis arachnoides, seen from above.



Pyxis arachnoides, seen from below

But one species, *Pyxis arachnoides*, is known. (Continent of India, and the islands of the Indian Archipelago.)

Genus *Kinixys*, Bell. *Characters.*—Feet with five toes, the posterior ones with four nails only; carapace moveable behind; sternum of a single piece.

MM. Duméril and Bibron observe that this is the most curious of the family *Chersites*. The Chelonians that compose it alone enjoy the faculty of moving the posterior part of their carapace in order to lower it and apply it against the plastron, so as completely to close the osseous box behind, as the *Pyxides* close theirs before when they elevate the moveable anterior portion of their plastron. But, as we have seen, the mobility of the anterior part of the sternum is in *Pyxis* due to the presence of an elastic ligament which performs the office of a hinge, whilst in *Kinixys* the carapace offers no really moveable articulation; the bones, the vertebræ, and ribs are the parts which bend. In consequence of this elasticity of the bones and their thinness, the carapace can be moved down to approximate the sternum. The sinuous line on which this flexion operates is indicated externally by a slight space, which is filled by a sort of fibro-cartilaginous tissue. This undulated line exists between the antepenultimate and the penultimate margino-lateral plate.

The three known species have not, like all the other *Chersians*, the abdominal plates much more extensive than the other horny plates of the sternum, which, joined to the enlargement and the rounded contour of the plastron behind, approximates them in a certain degree to *Cistudo*, the first genus of the *Elodians*.

Species.—*Kinixys Homeana* (Guadaloupe, Demerara); *Kinixys erosa* (Demerara); *Kinixys Belliana* (locality unknown: warm parts of America probably.

Pausanias notices a Land Tortoise in the woods of Arcadia, whose shell was used to make lyres.

II. Family Elodians—Marsh Tortoises.

Geographical Distribution of the Family.—MM. Duméril and Bibron observe that of the four families which compose the order Chelonians, that of the *Elodites* is the most numerous in genera, and above all in species. For Marsh Tortoises have been found in the Old World and in the New, and even in Australasia, where hitherto not one species of *Chersites* has been detected. America produces more species of *Elodians* than all the rest of the world put together; for, of the seventy-four species which compose that family, forty-six are exclusively American, and the remaining twenty-nine are divided between Australasia and the Old World. The cause of this disproportion rests in the vast body of water, which, in the form of lakes, ponds, and marshes, covers a certain portion of the American continent, as well as in the great rivers and tributary streams which traverse it in all directions. Africa, where the territory differs so much from that of America in this respect as well as in so many others, possesses but six species, three of which have at present been only found in Madagascar, one at Bourbon, and another at Cape Verd; whilst this same Africa is rich in Land Tortoises. Of the twenty-nine *Elodians* which are strangers to America, two only, *Platemys Macquaria* and *Chelodina Novæ Hollandiæ*, are natives of the last-mentioned country. Three belong to Europe, six to Africa, and the eighteen which remain out of the total number come from the East Indies or the Oriental Archipelago; that part of Asia, in short, which is most watered. But of all the Indian Elodians not one has the pelvis anchylosed to the plastron as well as to the carapace, and consequently immoveable; nor the neck retractile under one of the sides of the buckler; whilst the two New Holland species and the African Elodians are, on the contrary, in that condition; that is to say, *Pleuroderes*, which subfamily has its head-quarters in South America; for, out of twenty-three species of *Elodians* which there inhabit, five *Cryptoderes* only were known to MM. Duméril and Bibron, but not a single *Pleurodere* existing in North America: the six African species belong also to the *Cryptoderes.*

Habits of the Elodians.—These differ very much from those of the other three great groups of Chelonians. The Marsh Tortoises have not the slowness of the Land Tortoises. They swim with facility, and on land make much quicker progress than the *Chersians*. They frequent small streams whose course is not too rapid, lakes, ponds, and marshes: they are not almost entirely vegetable-feeders, like the *Chersians* and *Thalassians*, but, like the *Potamians*, prey on living animals; river-mollusks, Anurous and Urodele Batrachians, and Annelids are their food.

The sexes remain in conjunction for many weeks at one time of the year. The eggs are generally spherical, with a calcareous shell, and white, like those of the other Chelonians. The females deposit them in shallow cavities, which they hollow out in the earth, nearly in the same manner as the Land Tortoises; but the *Elodians* prefer the banks of the waters where they dwell, in order that their young ones may the more easily there find refuge from their numerous enemies. The number of eggs varies according to the species, and probably according to the age of the individuals, for the females are capable of producing fertile eggs for some years before they have attained their full growth.

Subfamily 1.—Cryptodere Elodians.

Cryptoderes are not only distinguished from the *Pleuroderes* by the power of completely concealing their cylindrical neck with its sheath of loose skin under the middle of the carapace; but also by their head, which is nearly equal in width to its height at the occiput. The eyes are always lateral, and their orbits so large that the diameter of the cavity nearly equals a fourth of the total extent of the cranium considered with regard to its length. The jaws of the *Cryptoderes* are stronger than those of the *Pleuroderes;* sometimes they are simply trenchant, sometimes more or less dentilated on their edges, which are straight, or sometimes sinuous. In the greater number of species the anterior extremity of the upper beak offers a large notch, on each side of which may be seen pretty constantly a rather strong tooth; in which case it is rare for the corresponding extremity of the mandible not to curve upwards towards the muzzle in a sharp point. In short, in such cases the upper beak closely resembles that of the FALCONIDÆ.

1st Subgenus.—*The Clausiles.*

Genus *Cistudo*, Fleming, reformed by Gray. *Characters.*—Feet with five toes, the posterior with four claws only; plastron wide, oval, attached to the buckler by a cartilage, moveable before and behind on the same transversal mesial hinge, furnished with twelve plates; twenty-five marginal horny plates or scales.

Species.—*Cistudo Carolina*, *Cistudo Amboinensis*, and *Cistudo trifasciata.*

2nd Subgenus.—*The Gapers.*

Species.—*Cistudo Europæa* and *Cistudo Diardii.*

Genus *Emys*, Dum. and Bibr. *Characters.*—Feet with five toes, the posterior with four nails only; plastron wide, immoveable, solidly articulated upon the carapace, furnished with twelve plates; two axillary and two inguinal shells; head of ordinary size, tail long.

1st Group.—*European Emydes.*

Species.—*Emys Caspica; Emys Sigriz.*

2nd Group.—*American Emydes.*

Species.—*Emys punctularia*, *Emys marmorea*, *Emys pulchella*, *Emys geographica*, *Emys concentrica*, *Emys serrata*, *Emys Dorbigni*, *Emys irrigata*, *Emys decussata*, *Emys rubriventris*, *Emys rugosa*, *Emys Floridana*, *Emys ornata*, *Emys concinna*, *Emys reticulata*, *Emys guttata*, *Emys picta*, *Emys Bellii*, and *Emys Muhlenbergii.*

3rd Group.—*African Emys.*

Species.—*Emys Spengleri.*

4th Group.—*Oriental Emydes.*

Species.—*Emys Trijuga*, *Emys Reevesii*, *Emys Hamiltonii*, *Emys Thurjii*, *Emys tecta*, *Emys Bealei*, *Emys crassicollis*, *Emys spinosa*, *Emys ocellata*, *Emys trivittata*, *Emys Duvaucellii*, and *Emys lineata.*

Genus *Tetraonyx*, Lesson. *Characters.*—Five toes, one of them without a nail on all the feet; sternum solid, wide, furnished with six pairs of plates; twenty-five marginal scales.

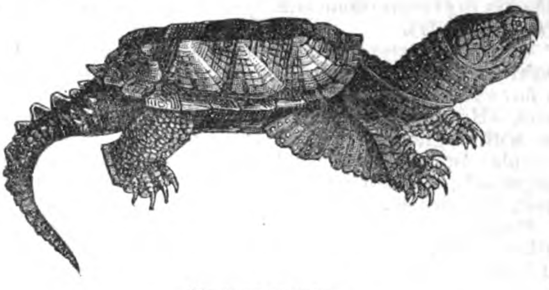
Species.—*Tetraonyx Lessonii* (East Indies), and *Tetraonyx Baska* (East Indies).

Genus *Platysternon*, Gray. *Characters.*—Head armed or shielded, and too large to enter under the carapace; upper jaw hooked; sternum wide, immoveable, fixed solidly to the carapace, with short alæ; three sterno-costal scales; five nails on the anterior feet; four only on the posterior feet; tail very long, scaly, without a crest.

Species.—*Platysternon megacephalum* (China).

Genus *Emysaura*, Dum. and Bibr. *Characters.*—Head large, covered with small plates; muzzle short; two barbles under the chin: plastron immoveable, cruciform, covered with 12 plates; three sterno-costal scales; five nails on the fore feet, four on the hind feet; tail long, surmounted by a scaly crest.

Species.—*Emysaura serpentina* (North America, where it lives in lakes and rivers, feeding on fish, and, as it would seem, on young birds). This is *Testudo serpentina*, Linn.; *Chelydra serpentina*, Schweigg.; and *Chelonura serpentina* of Say, &c.



Emysaura serpentina.

Genus *Staurotypus*, Wagler. *Characters.*—Head subquadrangular, pyramidal, covered in front with a single very delicate scale only; jaws more or less hooked; barbles under the chin; twenty-three limbar scales; sternum thick, cruciform, moveable in front, furnished with eight or eleven scales; axillary and inguinal scales contiguous, placed on the sterno-costal sutures; anterior feet with five nails; posterior feet with four only.

Species.—*Staurotypus triporcatus* (Mexico; River Alvaredo); and *Staurotypus odoratus*, so called from the musky odour which it is said to exhale (North America, where it lives in marshes and muddy currents, feeding on small fishes, worms, and mollusks).

Genus *Kinosternon*, Wagler. *Characters.*—Head subquadrangular, pyramidal; a single rhomboidal plate upon the cranium; jaws slightly hooked; barbles under the chin; scales of the shell slightly imbricated; limbar plates to the number of 23; sternum oval, moveable before and behind on a fixed piece, furnished with eleven scales; alæ short, narrow, sub-horizontal; a very large axillary plate and an inguinal still larger; tail long (in the males), unguiculate.

Species.—*Kinosternon scorpioïdes* (South America, in marshes and on river-banks); *Kinosternon Pennsylvanicum* (United States of America, where it lives in muddy waters, feeding on small aquatic animals, and exhaling a strong musky odour); *Kinosternon hirtipes* (Mexico).

Subfamily 2.—Pleurodere Elodians.

The *Pleuroderes*, as their name indicates, have, all of them, the neck retractile upon one of the sides of the anterior aperture of the carapace; but they are never able completely to draw it in between their fore-feet and under the middle of the buckler and plastron, like the *Cryptoderes.*

Genus *Peltocephalus*, Dum. and Bibr. *Characters.*—Head large, subquadrangular, pyramidal, covered with large, thick, slightly imbricated plates; jaws extremely strong, hooked, without dentilations; eyes lateral; plates of the carapace slightly imbricated; no nuchal plate; feet slightly palmated: two large rounded scales at the heels; nails straight, robust; tail unguiculate.

Species.—*Peltocephalus Tracaxa* (South America; Cayenne, Brazil).

Genus *Podocnemis*, Wagler. *Characters.*—Head slightly depressed, covered with plates; front hollowed with a large longitudinal furrow; jaws slightly arched, without dentilations; two barbles under the chin; no nuchal plate; sternum wide, immoveable; feet largely palmated, the posterior ones carrying at the heels two large but delicate rounded scales; tail short, not unguiculate.

Species.—*Podocnemis expansa* (South America; Cayenne; where it lives in streams and rivers); *Podocnemis Dumeriliana* (same locality).

Genus *Pentonyx*, Dum. and Bib. *Characters.*—Head large, depressed, covered with plates; muzzle rounded; jaws slightly arched, trenchant; two barbles under the chin; no nuchal plate; sternum immoveable; five claws on all the feet; tail moderate, not unguiculate.

Species.—*Pentonyx Capensis* (Cape of Good Hope; Senegal; and Madagascar); *Pentonyx Adansonii* (Cape Verd).

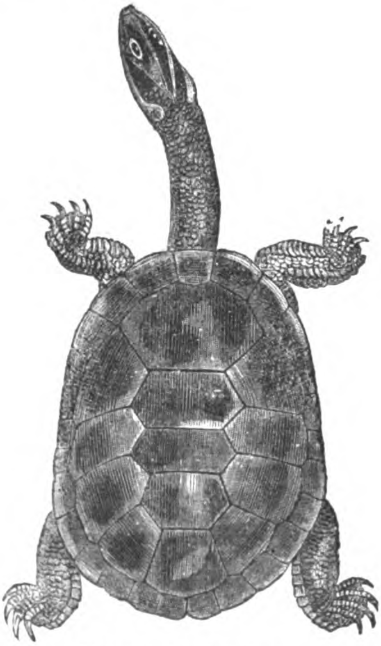
Genus *Sternothærus*, Bell. *Characters.*—Head depressed, furnished with great plates; jaws without dentilations; no nuchal plate; sternum wide, with very narrow lateral prolongations; free anterior portion of the plastron rounded, moveable: five claws on each foot.

Species.—*Sternothærus niger* (Madagascar); *Sternothærus nigricans* (same locality); *Sternothærus castaneus* (same locality).

Genus *Platemys*, Wagler, as reformed by MM. Duméril and Bibron, comprising part of *Hydraspis* of Gray, *Platemys, Rhinemys* and *Phrynops* of Wagler. *Characters.*—Head flattened, covered with a single delicate scale or with a great number of small irregular plates; jaws simple; two barbles under the chin; carapace very much depressed; sternum immoveable; five claws on the fore feet, four on the hind.

Species.—*Platemys Martinella* (Brazil and Cayenne); *Platemys Spixii* (Brazil); *Platemys radiolata* (Brazil, where it lives in the marshes); *Platemys gibba; Platemys Geoffreana* (young sent from Buenos Ayres by M. d'Orbigny); *Platemys Waglerii* (Brazil); *Platemys Nieuwiedii* (Brazil); *Platemys Gaudichaudii* (Brazil); *Platemys Hilarii* (Brazil); *Platemys Miliusii* (Cayenne); *Platemys rufipes* (Brazil; banks of the River Solimoens); *Platemys Schweiggerii* (South America); *Platemys Macquaria* (Macquarie River, New Holland).

Genus *Chelodina*, Fitzinger. *Characters.*—Head very long and very flat, covered with a delicate skin; muzzle short, gape wide, jaws feeble, without dentilations; no barbles to the chin; neck very much elongated; a nuchal plate, plastron immoveable, very wide, rounded in front and solidly fixed on the carapace; sternal alæ very short; intergular scale larger than each of the gulars; four claws on each foot; tail excessively short.



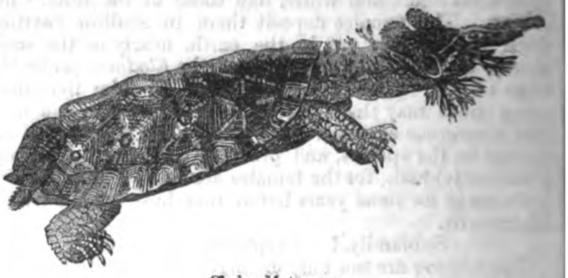
Chelodina Novæ Hollandiæ.

Species.—*Chelodina Novæ Hollandiæ; Chelodina flavilabris* (Brazil); *Chelodina Maximiliani* (South America: sent from Buenos Ayres by M. d'Orbigny).

Genus *Chelys*, Dum. and Bibr. *Characters.*—Head much depressed, wide and triangular; nostrils prolonged into a proboscis; gape wide, jaws rounded, of but little thickness; neck furnished with long cutaneous appendages, two barbles to the chin; a nuchal plate; five claws on the fore-feet, four on the hind.

The gape extends beyond the ears. MM. Duméril and Bibron remark that the jaws are rounded, narrow, and not simply covered with soft skin, as Cuvier, Wagler, and Gray believed, but protected by horny cases, like those of all the other Chelonians: only in *Chelys* they are extremely delicate.

Species.—*Chelys Matamata* (South America, Cayenne: in stagnant waters). A female lived some months at Paris and laid three eggs, one of which was hatched and the young animal preserved in the Paris Museum.



Chelys Matamata.

3rd Family.—Potamians, or River-Tortoises.

The species belonging to this family live constantly in the water, only coming out occasionally.

Geographical Distribution of the Potamians.—MM. Duméril and Bibron state that no species of this family have been observed in European rivers. All those which have been described and whose country is known, come from the streams, rivers, or great fresh-water lakes of the warmer regions of the globe—from the Nile and the Niger in Africa; from the Euphrates and Ganges in Asia; and from the Mississippi and Ohio, or some of the rivers that flow into them, in America: but MM. Dumeril and Bibron add that we are far from knowing all the species, for they have been a long time confounded under one name (*Trionyx*).

Habits, &c. of the Potamians.—It would seem that individuals of this family attain a large size. MM. Duméril and Bibron quote Pennant as mentioning some which weighed 70 lbs.; one which he kept three months weighed 20 lbs., and its buckler was 20 inches in length, not reckoning the neck, which measured 13½ inches. Their mode of life and habits seem to have great similarity. They swim with much ease both on the surface and at mid-water. The lower part of their body is generally pale white, rosy, or bluish; but their upper parts vary in their tints, which are most frequently brown or grey, with irregularly marbled, dotted, or ocellated spots. Straight or sinuous brown, black, or yellow lines are disposed symmetrically on the right and left, principally on the lateral parts of the neck and on the limbs. During the nights and when they believe themselves to be secure from danger, the Potamians come to repose on the islets, the rocks, the fallen trunks of trees upon the banks, or floating timber, whence they precipitate themselves into the water at the sight of man, or at the least alarming noise. They are very voracious and agile, and pursue, as they swim, reptiles, especially young crocodiles and fishes. Their flesh being esteemed, they are angled for with a hook and line baited with small fish or living animals, or with a dead bait, to which the angler gives motion and apparent life: for they are said never to approach a dead or immoveable prey.* When they would seize their food or defend themselves, they dart out their head and long neck with the rapidity of an arrow. They bite sharp with their trenchant beak, and do not let go till they have taken the piece seized out; so that their bite is much dreaded, and the fishermen generally cut off their heads as soon as they have caught them.

The males appear to be fewer in number than the females, or, at least, they come less frequently to the banks of rivers, where the females resort to deposit their eggs in hollows, which contain from fifty to sixty. The number varies according to the age of the females, which are less fruitful in proportion to their youth. The eggs are spherical, their shell is solid, but membraneous or slightly calcareous.

Genus *Gymnopus*, Dum. and Bibr. (*Trionyx*, Geoff.; *Aspidonectes*, Wagler). *Characters.*—Carapace with a cartilaginous circumference, very large, floating behind, and deprived of bone externally; sternum too narrow behind to hide the limbs completely when the animal draws them up under the carapace. *Trionyx* and *Testudo ferox* of authors.

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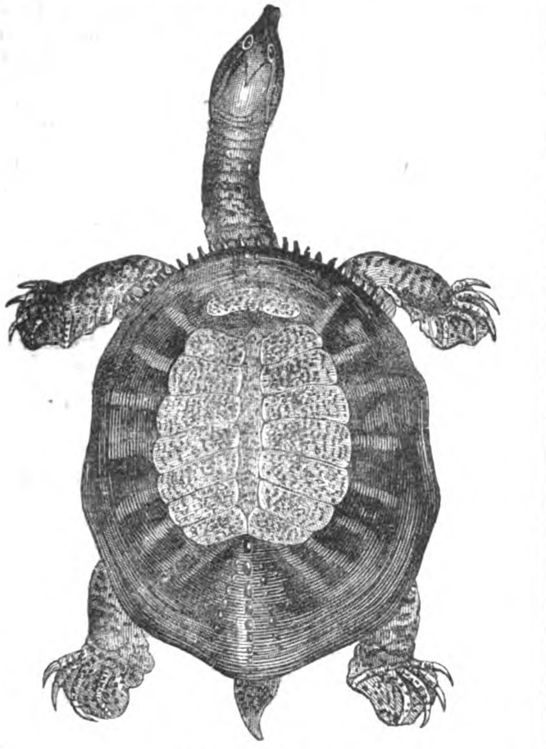
* This must be taken to apply to living animals only, for the Potamians are said to feed not merely on the young of the crocodiles, but also to be great destroyers of their eggs in the Nile and the Ganges.

Species.—*Gymnopus spiniferus* (North America, the rivers of Georgia and Florida, as well as the lakes situated above and below Niagara. Those sent to the Paris Museum by M. Lesueur were fished up in the Wabash, a river which enters the territory of Indiana and of the Illinois, and falls, a little before its junction with the Mississippi, into the Ohio).

M. Lesueur states that towards the end of April, or most frequently in May, the females of this species seek out on the river-banks sandy spots for the deposit of their eggs; steeps of ten or fifteen feet elevation deter them not when they are choosing places exposed to the sun. Their eggs are spherical, and their shell is more fragile than that of the eggs of the species of Edolians living in the same waters; their eggs amount to from fifty to sixty. M. Lesueur counted in the ovary twenty ready for laying, and a great quantity of others of variable dimensions, from that of a pin's head to the much greater volume which they attain when they are covered with their calcareous coat. The retreats of these tortoises are on rocks and on the trunks of trees overthrown in the river. They may be taken with hook and line baited with a little fish; they are very voracious, and bite their captors, so that the prudent cut off their heads. M. Lesueur was often bitten by those he had; they dart out their heads like lightning. The young begin to show themselves in July. The flesh of this species is very delicate.



Gymnopus Spiniferus.

Gymnopus muticus.—*Trionyx muticus*, Lesueur, Leconte, and Gray. (Same localities as *G. Spiniferus.*)

Gymnopus Ægyptiacus.—*Trionyx Ægyptiacus*, Geoff., *Trionyx Niloticus*, Gray. (The Nile, and, as it seems to MM. Duméril and Bibron, other African rivers; for the *Trionyx labiatus* of Bell, which in their opinion is this species, has been sent from Sierra Leone.)

This is supposed to be the ἐμύς (Emys) of Aristotle ('De Part. Anim.,' v. 9).

Gymnopus Duvaucelii—*Trionyx Gangeticus*, Cuv., *Trionyx Hurum*, Gray (the Ganges); *Gymnopus ocellatus, Trionyx ocellatus*, Hardwick, *Trionyx Hurum* (the young), Gray (the Ganges); *Gymnopus lineatus, Trionyx Ægyptiacus*, var. Hardw., *Trionyx Indicus*, Gray (Ganges); *Gymnopus Javanicus*—*Trionyx Javanicus*, Schweigg. (Java); *Gymnopus subplanus*—*Trionyx subplanus*, Geoff. (Ganges); *Gymnopus Euphraticus*—*Trionyx Euphraticus*, Geoff. (Tigris and Euphrates).

Genus *Cryptopus*, Dum. and Bibr. (*Trionyx*, Wagl.; *Emyda*, Gray). *Characters.*—Carapace with narrow cartilaginous borders supporting above the neck and behind the thighs small bony pieces; sternum large, forming in front a moveable door or lid which can hermetically close the aperture of the osseous box. The posterior part of the sternum furnished right and left with a cartilaginous operculum, shutting the apertures which give passage to the hind feet; there is a third operculum, besides, to stop the opening whence the tail issues.

Species.—*Cryptopus granosus. Trionyx granosus*, Schweigg. (Pondicherry; rather common on the coast of Coromandel; lives in fresh-water meers; the flesh is eaten); *Cryptopus Senegalensis* (Senegal).

4th Family.—Thalassians, Sea Tortoises, or Turtles. (*Cheloniadæ*, Gray; *Carettoïds*, Fitzing.; *Halychelones*, Ritgen; *Oiacopod Tortoises*, Wagl.).

This family is at once distinguished from all the others by the comparatively depressed carapace, and the long and broad paddles, the anterior of which are very much prolonged when compared with the posterior ones. Indeed, their limbs are entirely so modified as to become swimming organs.

Geographical Distribution of the Family.—The *Thalassians* are found in all the seas of warm climates, but principally towards the torrid zone in the equinoctial ocean, on the shores of the Antilles, Cuba, Jamaica, the Caiman Isles, and St. Domingo; in the Atlantic Ocean, at the Cape de Verd and Ascension Islands; in the Indian Ocean, at the Isles of France, Madagascar, Seychelles, and Rodriguez; at Vera Cruz in the Gulf of Mexico; and at the Sandwich and Galapagos Islands in the Pacific Ocean.

Habits of the Thalassians.—The turtles hardly ever leave the sea, excepting for the purpose of laying their eggs; but some accounts state that they will crawl up the shores of desert islands in the night, and clamber up the edges of isolated rocks far at sea, for the purpose of browsing on certain favourite marine plants. They have been seen in smooth water, as far as seven or eight hundred leagues from the land, floating motionless on the surface of the sea, as if they were dead, and it has been supposed that they are then asleep. They dive well, and can remain beneath the surface a long time, as might be expected from the extent and volume of their arbitrary lungs capable of retaining and furnishing a sufficient quantity of air while they are submerged.

MM. Duméril and Bibron speak of the *Potamians* and Turtles as exceptions to the rest of the *Testudinata*, which, generally speaking, can produce no other sounds than hisses: we find however from Mr. Darwin's account above given, that the Great Land Tortoises, the males at least, bellow loudly at the pairing season. The cries of the *Potamians* and of some *Chelones* have been noticed by observers, and especially those of the Coriaceous Turtle or *Sphargis*. Individuals of this last genus, when hampered in nets or grievously wounded, have been heard to utter loud roars, from which they derive their name.*

The food of the *Thalassians* consists principally of marine plants; but it appears that some of them, especially those which exhale a musky odour, *Chelone caouana* for instance, feed also on crustaceans and many species of mollusks, the cuttles especially. Their jaws are robust, like the beaks of birds of prey; solidly articulated and worked with highly developed muscles; and their horny beak, hooked above and below, is trenchant on the edges, and most frequently serrated, so as to assist in securing a slippery prey.

The circumstances which precede or accompany the act of continuing the species are far from well known, though the epoch of fecundation is pretty accurately fixed, and ordinarily takes place in the spring. The conjunction of the sexes is of long continuance, but authors are not agreed as to the mode of the *cavalage*, as it has been termed; nor as to its duration, some stating the time at fourteen or fifteen days, and others assigning twice that period. One point seems certain, that the union takes place in the water: but some say that the male remains on the carapace of the female the whole time; others that the two plastrons have been seen in contact,* and the heads of the two animals out of the water. Others, again, assert that the union being effected, the two individuals remain reversed *more canino*.

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* Σφαραγίζω, to roar or cry loudly.

The circumstances attending the deposit of the eggs are better known. To reach the destined spot, the females have often to traverse the sea for more than fifty leagues, and the males accompany them to the sandy beaches of those desert islands selected for the places of nidification. Arrived at the end of their voyage, they timidly come forth from the sea after sunset; and as it is necessary to leave the eggs above high-water mark, they have often to drag themselves to a considerable distance before they can hollow out their nests (about two feet in diameter) during the night, and there lay at one sitting to the number of a hundred eggs. This laying is repeated thrice, at intervals of two or three weeks. The eggs vary in size, but are spherical, like tennis-balls; and when they are laid, their investing membrane is slightly flexible, although covered with a delicate calcareous layer. After slightly covering the nest with light sand, the parent returns to the sea, leaving the eggs to the fostering influence of a tropical sun. The eggs are said to be hatched from the fifteenth to the twenty-ninth day; and when the young turtles come out, their shells are not yet formed, and they are white as if blanched. They instinctively make for the sea; but on their road, and as they pause before entering the water, the birds of prey that have been watching for the moment of their appearance hasten to devour them; whilst those that have escaped their terrestrial persecutors by getting into the sea, have to encounter a host of voracious fishes and legions of ambushed crocodiles.

Those that escape attain, under favourable circumstances, enormous dimensions. Individuals of the genus *Sphargis* have been known to weigh from 1500 to 1600 pounds; and some *Chelones*, whose carapace has measured in its circumference more than 15 feet, and near 7 feet in length, have weighed down more than from 800 to 900 pounds. Aged turtles often carry about with them on their carapace a little world of parasites, such as *Flustra*, *Serpulæ*, *Balani*, and *Coronulæ;* whilst certain *Annelids* securely fix themselves at the origin or base of the limbs, where the motion of the turtle cannot displace them.

Utility to Man, Chase, &c.—Though many of the other *Testudinata* are highly useful to man, especially as articles of food, none are of such great utility as the *Thalassians*. The advantages to be derived from them were not lost upon the antients; and though Mercury is said to have taken the first hint for the structure of a lyre from the dried carapace and tendons of a tortoise (a *Gymnopus*, probably), found by the god after an inundation of the Nile, and which sounded when he struck ‘ the chorded shell,’ the benefits arising from the *Thalassians* are, if not of so refined, of a much more substantial and varied nature. The inhabitants of those countries where the turtles grow to a large size do not merely derive from them a supply of food, but they convert their carapaces into boats, into huts, into drinking-troughs for their domestic animals, and baths for their children. The *Chelonophagi* of old, who inhabited the shores of India and the Red Sea, converted the enormous shells of the turtles which they caught into roofs for their houses and boats for their little voyages, as Strabo and Pliny testify. The latter, in the tenth chapter of his ninth book, enters at large upon the subject.

As an article of food the Green Turtles, *Tortues franches* of the French, are so highly prized, that they have become a considerable article of commerce. The fat of many species, when fresh, is used with success in lieu of butter and oil in cookery; and in those species which have a musky odour (*Chelones caouana* and *caretta* for instance), is used for embrocations, leather-dressing, and as lamp-oil.

The *Imbricated Turtles* furnish that valuable article *tortoiseshell*, or rather the best sorts of it, so highly prized in antient and modern times, and so ornamental and useful in the arts. The eggs of all the species, particularly those of the Green Turtles, are excellent.

In proportion to the benefits derived from the spoils of the turtles, the ingenuity of man has been sharpened by his eagerness to acquire them. One of the most obvious methods of capture was, and is, to watch the females as they emerge from the sea to deposit their eggs, and then turn them upon their backs on the high and dry sand, where they helplessly remain till the captors come to fetch them on the morrow. When the turtles lie floating on the sea, either for the purposes of sleep or respiration, the turtle-fishers approach them quietly with a sharp harpoon, carrying a ring at the butt-end, to which a cord is attached. The harpooner strikes, and the wounded animal dives, but is at last secured by the cord. In the South Seas skilful divers watch them when so floating, and, getting under the animals, suddenly rise, and so seize them. Mr. Darwin, with his usual felicity, describes another method of capture. In his account of Keeling Island, he says:—‘ I accompanied (April 6, 1836) Capt. Fitz-Roy to an island at the head of the lagoon: the channel was exceedingly intricate, winding through fields of delicately branched corals. We saw several turtles, and two boats were then employed in catching them. The method is rather curious: the water is so clear and shallow, that although at first a turtle quickly dives out of sight, yet in a canoe or boat under sail, the pursuers, after no very long chase, come up to it. A man standing ready in the bows, at this moment dashes through the water upon the turtle's back; then clinging with both hands by the shell of the neck, he is carried away till the animal becomes exhausted, and is secured. It was quite an interesting chase to see the two boats thus doubling about, and the men dashing into the water, trying to seize their prey.’ (*Journal.*)

But the most extraordinary mode of fishing is that said to be practised towards the coasts of China and the Mozambique, where turtles are taken by the aid of living fishes trained for the purpose, and thence named *fisher-fishes*. The fact appears to have been known to Columbus, and has been verified by Commerson and cited by Middleton and Salt. The fish is a species of *Echeneis* or *Remora*, and the islanders who use it are said to proceed in the following manner. They have, in their little boat, tubs containing many of these fishes, the top of whose head is covered with an oval plate, soft and fleshy at its circumference. In the middle of this plate is a very complicated apparatus of bony pieces, disposed across in two regular rows, like the laths of Persian blinds. The number of these plates varies from fifteen to thirty-six, according to the species; they can be moved on their axis by means of particular muscles; and their free edges are furnished with small hooks, which are all raised at once like the points of a wool-card. The tail of each of the trained fishes in the tubs is furnished with a ring, for the attachment of a fine but long and strong cord. When the fishermen perceive the basking turtles on the surface of the sea, knowing that the slightest noise would disturb the intended victim, they slip overboard one of their Remoras tied to the long cord, and pay out line according to their distance from the turtles. As soon as the fish perceives the floating reptile he makes towards it, and fixes himself to it so firmly that the fishermen pull in both fish and turtle to their boat, where the fish is very easily detached by pushing its head in a direction from behind forwards, and the turtle is secured.

Genus *Chelone*, Brongn. (*Caretta*, Merrem). *Characters.*—Body covered with horny scales or shells. One or two nails on each foot.

1st Subgenus.—*Chelonées Franches. Green Turtles.*

Characters.—Discoidal plates to the number of thirteen, not imbricated. Muzzle short, rounded. Upper jaw with a slight notch in front and small dentilations on the sides; horny case of the lower jaw formed of three pieces and having its sides deeply dentilated. A nail on the first toe of each foot.

Species.—*Chelone Mydas* (the Atlantic Ocean. MM. Duméril and Bibron observe that this and the three following species are so similar, that it is possible for them to form one species only: but they add that this question can only be satisfactorily solved by those who have opportunities of comparing the living animals); *Chelone virgata* (Teneriffe; Rio Janeiro; Cape of Good Hope; New York; Indian Seas; the Red Sea); *Chelone maculosa* (Malabar Coast); *Chelone marmorata* (Island of Ascension).

2nd Subgenus.—*Imbricated Chelones.*

Characters.—Plates of the disk imbricated and thirteen in number. Muzzle long and compressed. Jaws with straight edges without dentilations, curved slightly towards each other at their extremities. Two nails on each fin.

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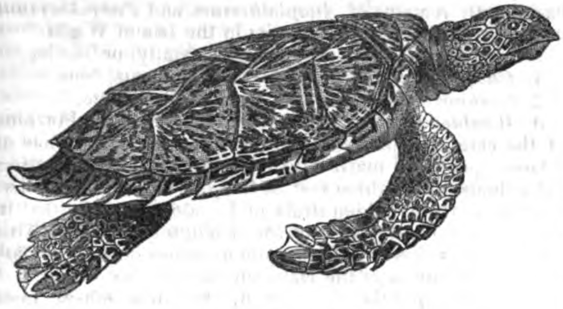
* This last account may be well doubted by those who are conversant with the organization of the animals.

Species.—*Chelone imbricata, The Hawk's-bill Turtle* of Catesby and Brown (Indian and American Oceans, the Isle of Bourbon, the Seychelles, Amboyna, New Guinea, the Havannah). Flesh bad. Eggs very good.



Chelone imbricata.

3rd Subgenus.—*Chelonées Caouanes. Logger-head Turtles.*

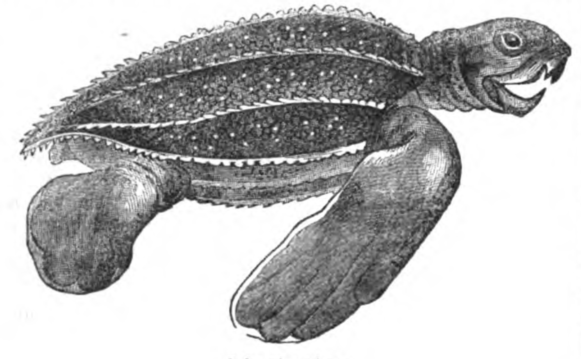
Characters.—Plates of the carapace not imbricated. Fifteen plates on the disk. Jaws slightly curved towards each other at their extremity.

Species.—*Chelone caouana*, the *Logger-head Turtle* of Catesby (the Mediterranean, also the Atlantic Ocean, Rio Janeiro); *Chelone Dussumierii—Chelonia olivacea* of Eschscholtz (China Seas and Malabar Coast).

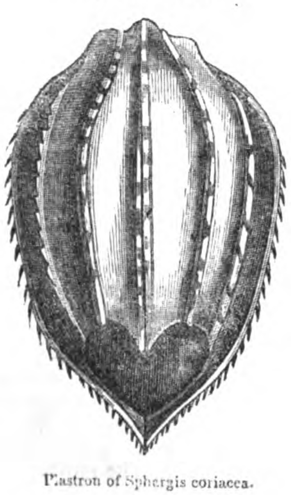
Genus *Sphargis*, Merrem (*Coriudo*, Flem.; *Dermatochelys*, Blainv.). *Characters.*—Body enveloped in a coriaceous hide, tuberculous in young subjects, completely smooth in adults. Feet without nails. (*Erpétologie.*)

Species.—*Sphargis Coriacea—Testudo Lyra*, Donnd. and Bechst.; *Tortue Luth* of the French; *Coriaceous* and *Tuberculated Tortoise* of Pennant. (Atlantic Ocean.)

This turtle has been taken on many of the European coasts: several of large size (700 and 800 lbs. in weight) have been captured on those of Britain. One case, where the capture was effected off the coast of Scarborough, should be a warning not to use it rashly as food. Pennant relates that one of the three taken in 1748, or 1749, was purchased by a family who invited several persons to partake of it. A gentleman present told the guests that the flesh was unwholesome, but one of the company persisted in eating of it, and suffered most severely, being seized with dreadful vomiting and purging; and yet the Carthusians, Pennant tells us, are said to eat no other species. It would seem, then, that the severe effect above noticed must have been accidental, and the animal may have been in an unhealthy condition. It is said to grow very fat; but the flesh is reported to be coarse and bad. The French name is given probably upon the supposition that it was the species used by the antients in the early construction of the lyre.



Sphargis coriacea.



Plastron of Sphargis coriacea.

Fossil Testudinata.

Cuvier commences his admirable treatise upon Fossil Tortoises by observing that the number of living species is so considerable, that it is very difficult to decide whether a fossil tortoise is or is not of an unknown species, inasmuch as it is not only necessary before arriving at this conclusion to compare the carapaces and plastrons covered with their horny plates or scales, as they are ordinarily seen in cabinets and represented in books, but also the skeletons, so that the observer may accurately study the joining of the ribs and other bones which concur to compose their cuirasses. He names twenty-nine species that he himself had stripped of their covering, and says that he had performed that operation on others beside. Thus he laid bare the characters which enabled him to distinguish the fossils as far as his examined species went; but he adds, with his usual philosophical candour, that it is only by induction that he could be guided in the case of those species which he had not at his disposition.

Cuvier begins with the fossil *Trionyces*, and distinguishes, 1, Those from the gypsum-beds of the environs of Paris; 2, Those from the gypsum-beds of Aix; 3, Those from the *molasse* of the department of the Gironde; 4, Those from the gravel and clay-beds of Hautevigne in the department of the Lot and Garonne; 5, Those from the gravel-beds in the neighbourhood of Castelnaudry; and 6, Those from the sandy beds in the environs of Avaray.

He next considers the *Emydes*, or *Freshwater Tortoises*, noticing, 1, Those from the Paris gypsum-beds; 2, Those discovered together with crocodiles in the Jurassic limestone of the neighbourhood of Soleure; 3, Those of the ferruginous sand of Sussex; 4, Those of the *molasse* of la Grave and those of the *molasses* of Switzerland; 5, Those from our isle of Sheppey; 6, Those from the environs of Brussels; and 7, Those from the marly sand (sable marneux) of the province of Asti.

The *Marine Tortoises*, or *Chelonians*, he divides into, 1, Those of the environs of Maestricht; and 2, Those of the slate of Glaris.

The *Land Tortoises* noticed are, 1, Those of the environs of Aix; and 2, Those found in the Isle of France under the volcanic beds.

The conclusions drawn by Cuvier are, that the tortoises are as antient inhabitants of the world as the crocodiles; that they accompany the remains of the latter generally; and that as the greater number of their remains belong to fresh-water or terrestrial species, they confirm the conjectures drawn from the bones of crocodiles as to the existence of isles or continents which were frequented by reptiles before the existence of viviparous quadrupeds, or at least before there was a sufficient number of these last to afford a quantity of remains at all comparable to those of reptiles.

Cuvier concludes by stating that he further knows of the remains of tortoises found in many different places, but whose characters are but little or badly determined: thus he remarks that some are found in the basin of Puy en Velay with fresh-water shells and the bones of quadrupeds, and that there are some which appear to be marine in the blue marls of the Plaisantin, so abundant in marine shells, bones of whales, &c.

Hermann von Meyer refers to all the fossil *Testudinata* known up to the time when he wrote (1832), but the following are the only species named:—

Trionyces, Parisiensis, and *Maunoir.*

Emys: no specific names are given, except such as *Emys de Sussex, E. de Sheppey*, &c., according to the localities; and *Euristernum?*, Wagl., is noticed from the Solenhofen slate.

It is the same with *Chelone*, with the exception of *Chelone Harvicensis*, and with—

Testudo, with the exception of *T. radiata ?*, *T. antiqua*, and *Testudinites Sellovii*.

Professor Owen, in his paper read before the Geological Society of London, in December, 1841, containing a 'Description of Six Species of Marine Turtles (*Chelones*) from the London clay of Sheppey and Harwich,' after quoting the generalizations given in the latest works which treat of Fossil Chelonians, and examining the evidence on which those from the Eocene clay of Sheppey had been referred exclusively to the fresh-water genus *Emys* by Cuvier and others, points out the circumstances which invalidate the conclusions that had been deduced from it. He then proceeds to describe the fossils, and to show the characters by which he has established the existence of five species of marine Turtles from the London clay at Sheppey, and a sixth species from the same formation near Harwich. The following are the species named by him:—

1, *Chelone breviceps*; 2, *Chelone longiceps*; 3, *Chelone latiscutata*; 4, *Chelone convexa*; 5, *Chelone subcristata*; 6, *Chelone planimentum*. (*Geol. Proc.*, vol. iii., 1841-1842.)

The same author, in his elaborate and highly satisfactory *Report on British Fossil Reptiles*, gives the following account of the order *Chelonia*:—

I. Family *Testudinidæ*, Tortoises, or Land-Tortoises.

1. *New Red-Sandstone Tortoises*. The most antient of the evidences of Chelonians in British formations appear to Professor Owen to be referrible to the Land-Tortoises; and he quotes the foot-prints from the quarries at Corncockle Muir, and those subsequently discovered at the quarries of Craigs, two miles east of Dumfries, as examples. [Salamandroides, vol. xx., p. 340.]

2. *Oolite Tortoises*. Examples, impressions of horny scutes about the size of those covering the carapace of a tortoise ten inches in length, in the oolite slate of Stonesfield.

II. Family Emydidæ, Fresh-water Tortoises.

1. An undetermined species in the museum of Professor Bell, from the Eocene clay near Harwich.

2. *Emys testudiniformis*, Owen (*Emys de Sheppey*, Cuv. ?). Sheppey.

3. *Platemys Bowerbankii*, Owen. Sheppey.

4. *Platemys Bullockii*, Owen. Sheppey.

5. *Tretosternon punctatum*, Owen. Purbeck limestone. N.B. Closely allied to *Trionyx*.

6. With regard to *Platemys Mantelli*, *Emys de Sussex*, Cuv., *Emys Mantelli*, Gray, Professor Owen remarks that the fossils discovered by Dr. Mantell in the Wealden strata of Tilgate Forest, and the resemblance of which to the flat species of Emydian discovered by M. Hugi in the Jura limestone at Soleure has been pointed out by Cuvier, are referrible to the pleurodcral section of the Emydian family, as arranged by MM. Duméril and Bibron, and in that section to the genus *Platemys* (*Hydraspis*, Bell); but that not enough of the skeleton of any individual has yet been obtained to afford a foundation for specific character.

7. *Large Emydian from the Kimmeridge Clay*. A bone in the museum of Sir P. Grey Egerton, Bart., from Heddington Pits, probably belonging to a species of *Platemys*.

8. *Footsteps of Emydians in New Red-Sandstone*. Stourton quarries, Cheshire.

Genus *Trionyx*. Professor Owen remarks that certain British fossils from the secondary formation referred to *Trionyx* have been proved to belong to another family of Chelonians: the supposed *Trionyx* from the new red-sandstone (Caithness) has been pronounced to be a ganoïd fish (genus *Coccosteus*) by Agassiz. Nor had Professor Owen when he wrote (1841) seen any Chelonite from the Wealden formation that could be confidently affirmed to belong to *Trionyx*.

1. *Femur from lias at Linksfield*, in the possession of Mr. Robertson of Elgin, 4¼ inches in length, and found with remains of *Plesiosaurus* and *Hybodus*. Though not identical in form with any *Trionyx* with which Professor Owen could compare it, he found it to resemble the modifications of the bone in that genus more closely than in Tortoises, Emydians, or Turtles. He remarks that although some of the Turtles of the Eocene period, as the *Chelone longiceps*, present such modifications of the jaws as seem to have adapted them to habits and food analogous to those of the *Trionyx*, yet evidences of this genus, to which the destruction of the eggs and young of crocodiles is more particularly assigned in the Nile and Ganges, are not wanting in certain localities where the London clay appears to have been deposited under circumstances analogous to those at the termination of equally gigantic rivers; and he adds that unequivocal portions of a true *Trionyx* have been obtained from the Eocene clay at Sheppey, and at Bracklesham, and that they are also associated, as in the Paris basin, with remains of *Anoplotherium* and *Palæotherium* in the Eocene limestone deposits in the Isle of Wight.

III. Family Chelonidæ, Thalassian family, or Turtles.

1. *Chelone planiceps*, Owen. Portland sandstone.

2. *Chelone obovata*, Owen. Purbeck limestone.

3. *Wealden Chelone*, an undetermined species. Portions of the carapace, plastron, and bones of the extremities of a large species of marine turtle, some of them indicating individuals nearly three feet in length—discovered by Dr. Mantell in the Wealden strata of Tilgate Forest (figured in the Doctor's *Illustrations of the Geology of Sussex*). This species in Professor Owen's opinion comes nearest to *Chelone planimentum* of the Harwich Eocene clay.

4. *Chelone pulchriceps*, Owen. Superincumbent beds of the lower greensand; greensand near Barnwell, Cambridge.

5. *Chelone Benstedi*, Owen. (*Emys Benstedi*, Mant. Chalk; Burham, Kent.

Professor Owen then proceeds to notice the *Eocene Tertiary Chelones* (see above, his paper read before the Geological Society of London), and concludes by observing that the indications of Chelonites from Eocene strata in the works of Parkinson, Woodward, and König, being unaccompanied by the anatomical deductions essential to the establishment of their true affinities, have been either misinterprêted or neglected; and except the citation of Woodward's *Chelone Harvicensis*, in M. H. von Meyer's compilation, the existence in the London clay of fossil *Emydes* alone has been recognised in the latest summaries of the present branch of palæontology. 'These therefore,' continues the Professor, 'could indicate but little difference between the present Fauna and that of the Eocene period in regard to the Chelonian order. But the case assumes a very different aspect when we arrive at the conviction that the majority of Sheppey Chelonites belong to the marine genus *Chelone*, and reflect that the number of extinct Eocene turtles from that limited locality exceeds that of all the well-determined species of *Chelone* now known to exist. For notwithstanding the assiduous search of the naturalist-collector, and the attractions which the shell and flesh of turtles offer to the commercial voyager, the tropical seas, though so often traversed, have not as yet yielded more than five good species of *Chelone*; and of these only two, as *Chelone mydas* and *Chelone caretta*, are known to frequent the same locality. Now, whilst it is obvious that but a small proportion of the organized treasures of the vast deposit of petrified mud and clay which fills the London basin have been brought to light, the results of the examination of fossil Chelonites evidently show that the antient ocean of the Eocene epoch was more abundantly provided with turtles, and that these presented a greater variety of specific modifications than the same extent of ocean in any of the warmer parts of the earth at the present day.

'The indications which the Sheppey turtles give, in conjunction with the other organic remains from the same depository, of the higher temperature that prevailed in the latitude in which they lived, cannot be overlooked; yet at the same time the conditions which allow the attainment of the size which the present tropical turtles often exhibit, would seem not to have been present in the time and place of existence of the extinct species of *Chelone* above enumerated; and again, the affinities to the fresh-water forms which the skeletons of some of the Eocene *Chelones* exhibit, accord with the indications that they inhabited the æstuary of a great river.'

TORTOLA. [Virgin Islands.]

TORTO'NA, *the Province of*, an administrative division of the Sardinian States, is bounded on the north by the Po, which divides it from the province of Mortara; east by the provinces of Voghera and Bobbio; south, by the Ligurian Apennines, which separate it from the duchy of Genoa; and west by the province of Alessandria. The rivers or torrents Scrivia and Curone, both affluents of the Po, rise in the Ligurian Apennines, and cross the province of Tortona from south to north. The province contains about

50,000 inhabitants, distributed in fifty communes. The head town, TORTONA, built upon an eminence near the Scrivia, is a bishop's see, and has about 9000 inhabitants, several churches and convents, and a royal college. In the cathedral is an antient basso-rilievo representing in the centre the downfall of Phaëton, and on the sides Castor and Pollux, with two Greek inscriptions underneath, the meaning of one of which is, that daring shows noble blood, and that of the other is, the mere truism that no one is immortal. (Valéry, *Voyages en Italie*.) The citadel of Tortona was built by king Victor Amadeus III., and destroyed by the French in the revolutionary wars. West of Tortona, in the direction of Alessandria, is the plain of Marengo, with the villages of Marengo and San Giuliano, where Bonaparte gained an important victory over the Austrians, in June, 1800. Tortona was antiently a town of the Ligurians, and was called Derton, or Dertona. After the Roman conquest it became a colony (Pliny, *Hist.*, iii. 7), and was a place of importance, being situated on the road leading from the banks of the Po to the coast of Liguria and Southern Gaul. In the middle ages Tortona was a free municipal community. It joined Milan and other Lombard cities in their resistance against the emperor Frederic I., was besieged and taken by him after an obstinate defence, and was plundered and partially destroyed, A.D. 1154. The people of Pavia, who were old rivals of those of Tortona, joined the imperial troops, and showed themselves most eager for the destruction of their neighbours. The citizens of Milan assisted those of Tortona in rebuilding their walls, but Tortona never after recovered its former prosperity. It joined the Lombard league, and was included in the peace of Constance. It passed successively under the dominion of the Visconti, and of the Spanish governors of Milan, and was taken and retaken by the French, Spaniards, Austrians, and Piedmontese in the wars of the seventeenth and eighteenth centuries, and was finally retained by the king of Sardinia. The territory of Tortona is very fertile, but the town looks dull and decayed. The other towns of the province of Tortona are,—1, Castelnovo di Scrivia, a town of 5500 inhabitants, north of Tortona and near the confluence of the Scrivia and the Po. It is the birth-place of Bandello, a well-known novelist of the sixteenth century. 2, Ponte Curone, on the river of that name, a town of about 2000 inhabitants. 3, Sale, a town of 4000 inhabitants, near the confluence of the Bormida and the Po. 4, Fabbrica, a town of 2000 inhabitants, in the Apennines, offsets of which spread over the whole southern part of the province. In these mountain tracts the inhabitants are mostly shepherds and goatherds, and their cheese is an article of exportation, as likewise are the mushrooms which grow abundantly here, and are dried and exported chiefly to Genoa, where there is a great consumption of them.

(Denina, *Quadro Statistico dell'Alta Italia; Calendario Sardo*; Neigebaur, *Gemälde Italiens*.)

TORTO'SA, a large town of Catalonia in Spain, and the capital of a considerable district of that name, is situated at the foot of a steep mountain on the left bank of the Ebro, and about 13 English miles from the mouth of that river: in 40° 48′ N. lat. and 36′ E. long. Tortosa is the antient Dertosa, known from inscriptions to have been a Roman municipium, and the capital of the Ilergaones. It became a flourishing city under the Moors, owing to its favourable situation for trade, being placed on a navigable river and not far from the harbours of Fangas and Alfaques, which last still retains its Moorish name, the word *Al fakk* meaning a jaw and a harbour in the sea. It was taken from the Moors in 1141 by Raymond V., last Count of Barcelona, and again recovered by them; being several times taken and retaken under the reign of that prince, until he finally united it to his dominions of Arragon. On one of the above occasions the women of Tortosa distinguished themselves by their courage and patriotism. The Moors having suddenly invested the place at night when the garrison were absent, the women mounted the ramparts, and defended the place so vigorously that the enemy was repulsed and compelled to raise the siege. In commemoration of this exploit, Raymond instituted the military order of 'la Hacha' (the taper or light). Tortosa is the see of a bishop, who is suffragan of Tarragona. The city is badly built, and with the exception of the castle, where the military governor resides, and the cathedral, a fine building, with three naves, erected at the expense of the inhabitants in 1593—there is nothing worth the attention of the artist. During the Peninsular war, Tortosa, which is defended by a wall and six advanced forts, sustained a siege against the French, commanded by Marshal Suchet, but the garrison after a vigorous defence was obliged to capitulate, on January 2, 1811. The environs of the city are well cultivated, and produce wine, corn, and oil in great abundance. The inhabitants are chiefly occupied in the coasting trade. The population, according to Miñano, did not exceed 12,000 inhabitants in 1826. Tortosa is the birth-place of Pope Adrian VI.

TORTRIX, Oppel's name for a genus of serpents, synonymous, according to Cuvier, with *Anilius* of Oken, *Torquatrix* of Gray, and *Ilysia* of Hemprich and Fitzinger.

Cuvier, who places the genus immediately before UROPELTIS, which last is followed by BOA, observes that Tortrix is distinguished from the ORVETS even externally, inasmuch as the scales of the row which runs along the belly and under the tail are a little larger than the others, and inasmuch as their tail is extremely short. He says they have only one lung. *Locality* of known species, America. Example, *Tortrix Scytale*. Mr. J. E. Gray (*Synopsis of Brit. Mus.*, 1840) places *Ilysia* in the family *Boidæ*, between *Clothonia* and *Cylindrophis*.

TORTU'GA, island. [ANTILLES.]

TORTU'GAS. [FLORIDA.]

TORTURE, which in a legal sense means the application of bodily pain in order to force discoveries from witnesses, or confessions from persons accused of crimes, has been recognised by the laws of most civilized nations as an instrument for obtaining judicial truth. A learned civilian terms it 'Mos antiquissimus, omnium ferê bene institutorum populorum communis: ut non immeritò pro lege ac jure quodam gentium habeatur.' (Wesenbechii *Paratitla ad Dig. de Quæstionibus*, num. 3.) Torture was applied to slaves at Athens (Demosthen., *Orat. adv. Pantænet*); and Cicero states that the Athenian and Rhodian laws allowed it to be applied even to citizens and freemen (*Oratoriæ Partit.*, 34); but there is some doubt as to the accuracy of this statement with respect to Athenian freemen. It has been questioned whether torture was used by the Romans during the republican period; but Cicero frequently speaks of it as an antient practice, and attributes it to the customs and institutions of an earlier age ('moribus majorum'). (*Oratio pro Rege Deiotaro*, c. 1; *Pro Milone*, c. 22; *Orat. Partit.*, 34.) Tacitus also ascribes a modification of the practice to an antient Senatus-consultum (*Ann.*, lib. ii., c. 30). However this may have been, it is beyond all doubt that the use of torture in judicial inquiries had become fully established in the time of the early emperors. Regularly the Roman law admitted the torture only in the case of slaves when examined either as witnesses or offenders; but under the emperors,—even under Augustus, but more frequently under Tiberius and Caligula,—instances occur in which freemen and citizens were interrogated by torture: most of these instances however are to be considered as irregular acts of power, not sanctioned by law. Rules regulating the mode of applying torture, and limiting the occasions of its application, were early established in the Roman law. One of the most important of these is that which Cicero in the passages above cited refers to antient usage, namely, that a slave should not be tortured to give evidence against his master, except in the cases of incest and conspiracy. Tacitus says that in order to evade the operation of what he calls an antient decree, prohibiting the 'quæstio servi in caput domini,' Tiberius, 'novi juris repertor,' invented the scheme of making over the slave from the accused to a public functionary, and then putting him to the torture against his former master. This device is however ascribed by other historians to Augustus. (Dion, lib. lv.) In judicial inquiries or public trials for crimes, the 'quæstio' was applied at the instance of the accuser in the presence of the prætor and judices, and the statements made under torture were reduced into writing (in tabulas relata), and signed by the prætor (Heineccius, *Ant. Rom.*, lib. iv., c. 18, sect. 25); but private persons also were permitted 'in foro domestico' to extract evidence from their slaves by torture. (Cicero, *Orat. pro Cluentio*, cc. 63, 66; Quintilian, *Declam.*, 328, 338, 353.) At a later period of the Roman empire many new regulations appeared, and the earlier restrictions upon this practice were wholly removed or greatly modified.

Several exceptions to the rule, which prohibited 'quæstiones in caput domini,' were introduced, and even freemen were subjected to torture, when there was positive evidence of the 'corpus delicti,' and probable or presumptive evidence that the accused was the guilty person. Moreover when the offence was of a grave character, and affected the head of the state immediately, personal exemptions from torture were not admitted. 'Omnes omninó,' says the 'Digest' (lib. xlviii., tit. 18; *De Quæstionibus*, sect. 10), 'in majestatis crimine, quod ad personas Principum attinet, cum res exigit, torquentur.' (Wasserschleben, *Historia Quæstionum per Tormenta apud Romanos*, Berol., 1836.)

It is remarkable, considering the extent to which the practice of torture was eventually carried by the Inquisition, that according to the principles and early practice of the Canon law all severities of criminal justice were prohibited; and by the antient decretals of the church, every ecclesiastical person who took part in them was liable to censure. Previously to the 13th century no trace of the use or permission of torture is to be found in the canon law, either in the process of accusation, which was founded entirely on the model of the Roman law, or in the inquiry. In the 13th century the severe rules of the Roman law respecting the torture of witnesses and accused persons 'in crimine majestatis' began to be applied by the ecclesiastical law in the case of heresy, which was then considered and termed 'crimen læsæ majestatis divinæ.' Nevertheless the earlier councils relating to the Inquisition, though violent in their denunciations against heretics, are silent respecting the use of torture; and the first trace of any ecclesiastical sanction of this mode of proceeding, even in the case of heresy or apostasy, is found in a decree of Innocent IV. in 1252; which however does not authorize the inquisitors to use it, but calls upon the civil magistrates to press offenders to confession against themselves and others by means of torture. At a subsequent period the necessity for secrecy in the proceedings of the Inquisition induced the use of torture by the inquisitors themselves, and the extent to which it was afterwards used is notorious. (Biener's *Geschichte des Inquisitions-Processes*, p. 73-4.) An instance of the application of torture under the ecclesiastical law occurred in England, under remarkable circumstances, about 60 years after the first sanction of the practice by the Church of Rome. In the great contest between Clement V. and the Templars in 1310, inquisitors were appointed by the pope to examine the prisoners who were charged (among other offences) with apostasy and heresy. The Archbishop of York, who was one of the inquisitors, propounded to certain monasteries and divines several difficulties which had occurred to him respecting the mode of conducting the examinations. Among other questions he asked, whether they might make use of torture, 'licet hoc in regno Angliæ nunquam visum fuerit vel auditum? Et si torquendi sunt, utrum per clericos vel laicos? Et dato, quód nullus omnino tortor inveniri valeat in Angliâ, utrúm pro tortoribus mittendum sit ad partes transmarinas?' (Hemingford, p. 256.) In consequence of the doubts of the archbishop, Edward II. refused to allow the inquisitors to torture the accused. Upon this Clement wrote a letter of remonstrance to the king, who referred the matter to the council; and upon their recommendation, it was resolved that the Templars should in the first place be separately confined and examined singly; and if upon this mode of proceeding they refuse to confess more than they had previously done, 'quód extunc *quæstionarentur*, ita quód quæstiones illæ illatæ fierent absque mutilatione et debilitatione perpetuâ alicujus membri, et sine violentâ sanguinis effusione.' (Raynouard, *Monumens Historiques relatifs à la Condamnation des Chevaliers du Temple*, pp. 131, 132.) In accordance with this resolution, a special commission from the king authorized the inquisitors 'to dispose and deal with the bodies of the Templars in *quæstionibus* et aliis ad hoc convenientibus,' as might seem fit to them to be done according to ecclesiastical law; and a precept was issued to the sheriffs of London, in whose custody the accused were, to suffer the inquisitors to examine them and put them to the torture. (Rymer's *Fœdera*, tom. iii., pp. 228, 232.)

Judicial torture formed a part of all the legal systems of Europe which adopted the Roman law. In Germany it was gradually introduced as the use of the Roman law increased, and displaced the antient Teutonic and feudal proceedings by ordeal and battle. Indeed while these judicia dei continued in use, there is no notice of the existence of torture. In most German cities judicial torture was unknown until the end of the fourteenth century; although it appears in the statutes of the Italian municipalities at a much earlier period. (Mittermaier's *Deutsche Strafverfahren*, theil i., pp. 73, 394.) A species of torture was indeed employed in Germany to a very great extent during the middle ages, of which there are traces and traditions connected with the torture-chambers and instruments still exhibited in Nürnberg, Salzburg, Ratisbon, and other antient cities and castles; but these were in general not used for legal or judicial torture, but for the proceedings of those secret religious tribunals, or 'Fehmgerichte,' which abounded at that period. The regular torture however, as derived from the Roman law, continued in many European states until the middle of the last century, when more enlightened views on the subject of jurisprudence led to a prevailing conviction of the inefficacy and injustice of this mode of ascertaining truth. In France the 'question préparatoire' was discontinued in 1780 by a remarkable decree, which is to be found in Merlin's 'Répertoire,' vol. x., p. 502; and torture in general was abolished throughout the French dominions at the revolution in 1789. In Russia its abolition though recommended by the empress Catharine in 1763 was not effected until 1801. In Austria, Prussia, and Saxony it was suspended soon after the middle of the last century; but although so seldom used as to be practically extinct, torture continued to form part of the laws of Bavaria, Hanover, and some of the smaller states of Germany within the last forty years. (Mittermaier's *Deutsche Strafverfahren*, theil i., p. 396, note.) In Scotland, where the law is almost wholly founded upon the civil law, the use of torture prevailed until the reign of Queen Anne, when it was declared by the act for improving the union of the two kingdoms (7 Anne, c. 21, s. 5), that in future 'no person accused of any crime in Scotland shall be subject or liable to any torture.'

The history of the use of torture in England is curious. From the hesitation to apply it to the Templars in the reign of Edward II. (1310), as above mentioned, as well as from the express statement of Walter de Hemingford, it appears to have been at that time unknown in England, either as an act of prerogative, or as an instrument of criminal inquiry in the ordinary course of law. Nevertheless, Holinshed relates that, in 1468, Sir Thomas Coke, the lord mayor of London, was convicted of misprision of treason upon the evidence of one Hawkins given under torture; and that Hawkins himself was convicted of treason by his own confession on the rack, and executed. From this period until the Commonwealth the practice of torture was frequent and uninterrupted, the particular instances being recorded in the council-books, and the torture-warrants in many cases being still in existence. The last instance on record occurred in 1640, when one Archer, a glover, who was supposed to have been concerned in the riotous attack upon Archbishop Laud's palace at Lambeth, 'was racked in the Tower,' as a contemporary letter states, 'to make him confess his companions.' A copy of the warrant under the privy seal, authorising the torture in this case, is extant at the State Paper-Office. With this instance the practice of torture in England ceased, no trace of its continuance being discernible during the Commonwealth or after the Restoration. But although the practice continued during the two centuries immediately before the Commonwealth without intermission, it was condemned as contrary to the law of England, and even declared to be unknown in this country by judges and legal writers of the highest character who flourished within that period. Thus Fortescue, who was chief justice of the court of King's Bench, and wrote his book 'De Laudibus Legum Angliæ' in the reign of Henry VI., and who notices a case of false accusation under torture (which was probably the case of Sir Thomas Coke above mentioned), condemns the practice in the strongest terms, though he does not expressly deny its existence in England. (Fortescue, cap. 22.) Again, Sir Thomas Smith, a very eminent lawyer, statesman, and scholar, who wrote in the early part of Elizabeth's reign, says that 'torment or question, which is used by the order of the civil law and custom of other countries, is not used in England. It is taken for servile.' (Smith's *Commonwealth of England*, book ii., cap. 27.) And Sir Edward Coke, who wrote in the reign of James I., says 'there is no law to warrant tortures in this land; and there is no one opinion in our books, or judicial record, for the maintenance of them.' (3 *Inst.*, 35.) Notwithstanding this explicit denunciation of the practice as against law, both Smith and Coke repeatedly acted as commissioners for interrogating prisoners by torture (Jardine's *Reading on the Use of Torture in England*); and the latter, in a passage which occurs in the same book, and only a few pages before the words just cited (p. 25), impliedly admits that torture was used at examinations taken before trial, though it was not applied at the arraignment or before the judge. There is also a direct judicial opinion against the lawfulness of torture in England. In 1628, the judges unanimously resolved, in answer to a question propounded to them by the king in the case of Felton, who had stabbed the duke of Buckingham, 'that he ought not to be tortured by the rack, for no such punishment is known or allowed by our law.' (Rushworth's *Collections*, vol. i., p. 638.) And yet several of the judges who joined in this resolution had themselves executed the warrants for torture when they held ministerial offices under the crown. Possibly the explanation of this inconsistency between the opinions of lawyers and the practice may be found in a distinction between prerogative and law, which was better understood two centuries ago than it is at the present day. It was true, as the above authorities declared, that torture was not part of the common law; it was not used in judicature, as it was by the Roman law and the legal systems derived from it in Germany, Italy, and Spain; and therefore in England no judge could by law direct the torture to be applied, and no party or prosecutor could demand it as a right. But that which was not lawful in the ordinary course of justice was often lawful for the prerogative of the crown, which authorized this mode of enforcing the discovery of crimes affecting the state, such as treason or sedition, and sometimes of offences of a grave character not political,—acting in this respect independently of and even paramount to the common law, in accordance with the doctrine asserted so early as the reign of Edward I., 'quod Rex pro communi utilitate per prerogativam suam in multis casibus est suprà leges et consuetudines in regno suo usitatas.' (*Rolls of Parliament*, 20 Edw. I., A.D. 1292, vol. i., p. 71.) This view of the subject is confirmed by the circumstance that in all instances of the application of torture in England, the warrants were issued immediately by the king, or by the privy council. Objectionable as the use of torture was in all countries and under all circumstances, it was in no country so unjust and dangerous an instrument of power as in England. In other countries, where it formed part of the law of the land, it was subject to specific rules and restrictions, fixed and determined by the same law which authorized the use of such an instrument, and those who transgressed them were liable to severe punishment. But in England there were no rules, no responsibility, no law beyond the will of the king. 'The rack,' says Selden, 'is nowhere used as in England. In other countries it is used in judicature when there is *semiplena probatio*, a half-proof against a man; then, to see if they can make it full, they rack him if he will not confess. But here in England they take a man and rack him,—I do not know why nor when,—not in time of judicature, but when somebody bids.' (*Table-Talk*, 'Trial.')

The particular modes of applying torture were as various as the ingenuity of man is fertile in devising the means of inflicting bodily pain. Cicero and other Roman writers speak of the *equuleus*, or *eculeus*, and the *fidiculæ*, as common instruments of torture; but it is extremely doubtful what they were. Much discussion respecting them, and a reference to the various authors who have mentioned them, will be found in a treatise entitled 'Hieronymi Magii Anglarensis de Equuleo Liber Posthumus,' Amsterdam, 1664. The rack, which was common throughout Europe, was a large frame, in shape somewhat resembling a mangle, upon which the examinant was stretched and bound; cords were then attached to his extremities, and, by a lever, gradually strained, till, when carried to its utmost severity, the operation dislocated the joints of the wrists and ankles. This engine is said to have been brought into the Tower by the duke of Exeter in the reign of Henry VI., and was thence called the duke of Exeter's daughter. (3 *Inst.*, 35.) Besides the rack there were endless varieties of what were termed the 'lesser tortures,' such as thumb-screws, pincers, and manacles. In England, one of the most dreaded engines of this kind was the scavenger's daughter, so called by a popular corruption from Skevington's daughter, being invented by Sir William Skevington, a lieutenant of the Tower in the reign of Henry VIII. (Tanner's *Societas Europæa*, pp. 12, 18.) This engine was found in 'Little Ease,' in the Tower, in 1604, by a committee of the House of Commons appointed to inquire as to the state of the dungeon so called. (*Commons' Journals*, 14th May, 1604.) In Scotland the instruments were the boots, called in France 'le brodequin' (in which the torture was applied by driving in wedges with a hammer between the flesh and iron rings drawn tightly upon the legs); the thummikins; the pinniewinks, or pilliewinks; the caspitaws, or caspicaws; and the tosots. (Maclaurin's *Introduction to Criminal Trials*, sect. 9.) The particular construction of these barbarous instruments it would be difficult at the present day to ascertain, but several of them were in practical use in Scotland within twenty years from the final abolition of torture in that country in 1708. (Howell's *State Trials*, vol. vi., p. 1217, note.)

It is remarkable that although the use of torture in judicature has prevailed in most civilized countries, it has been almost universally denounced by enlightened jurists of all ages. Cicero repeatedly condemns it as unjust and inefficacious; and even the civil law, which has sanctioned the practice in Europe for many centuries, speaks of it as 'a deceitful and dangerous instrument, which very often fails to extract the truth.' (*Dig.*, lib. xlviii., tit. 18.) The opinions of eminent lawyers in England have been already cited; and the juridical writers of the Continent, in more recent times, have unanimously taken the same view of the subject. (Mittermaier's *Deutsche Strafverfahren*, theil i., p. 396.) On the other hand, a curious defence of torture will be found in Wiseman's 'Law of Laws, or the Excellence of the Civil Law,' p. 72.

TORUS. [MOULDINGS.]

TORY. This name has now, for about two hundred years, served to designate one of two principal political parties in this country. It is not to be expected that for so long a time the name has been always associated with one uniform set of political principles, or that any formula could be devised which would accurately describe Toryism at every period of its history. Extending, like the name of the other principal political party, from the legislature through every class of the community, it would naturally, where the number of persons to be brought to concur in any change is so large, preserve any meaning which it has once acquired for a length of time, and throughout perhaps a general consistency of meaning; but on the other hand, engaged as the Whig and Tory parties of the legislature have been without intermission in a struggle for power, which power is attended by profit, they have been always exposed to the temptation, from whose insensible workings even the best disposed men are not secure, of altering and adapting opinions so as to facilitate the gaining what they fight for, or the keeping what they have gained: and the far more numerous members of the party who are without the legislature would generally follow those whom they look upon as their leaders, and by whose success every adherent of the party has some hope of being benefited.

And indeed with a large portion of either political party, the leading men in it for the time and the name are all that is thought of or cared for. Changes of political circumstances in the country would necessarily, and may always, without infringement of the honour of individuals, introduce change into the character of a party: and there will ever and anon come some new and unforeseen case of politics, which old principles are not adequate to solve, but on which the fundamental difference between opposing parties ensures different decisions, and ever after there is a new element in the idea of the party.

The name Tory, as well as the name Whig, and the existence of two parties in the state corresponding to those which have now been known for a long time as Whig and Tory parties, date from the reign of Charles II. There had been previous divisions of political opinion, but of these the sword had been made the arbiter: and it was not until after the Restoration, when the whole nation was sick of civil war and of the endless changes which the suspension of royalty had engendered, when the preservation of monarchy was henceforth an object with all, when at the same time the power of the House of Commons had been established, and it was now absolutely necessary for the king's advisers to gain, some way or another, the assent of a body which they could no longer endeavour to coerce, that political differences in the nation led to systematic struggles in Parliament, and to the forming and nick-naming of parties. 'It was in the year 1679,' says Mr. Hallam, 'that the words Whig and Tory were first heard in their application to English factions; and though as senseless as any cant terms that could be devised, they became instantly as familiar in use as they have since continued. There were then indeed questions in agitation which rendered the distinction more broad and intelligible than it has generally been in later times. One of these, and the most important, was the Bill of Exclusion, in which, as it was usually debated, the republican principle, that all positive institutions of society are in order to the general good, came into collision with that of monarchy, which rests on the maintenance of a royal line, as either the end or at least the necessary means of lawful government. But as the exclusion was confessedly among those extraordinary measures to which men of Tory principles are sometimes compelled to resort in great emergencies, and which no rational Whig espouses at any other time, we shall better perhaps discern the formation of these grand political sects in the petition for the sitting of parliament, and in the counter addresses of the opposite party.' (*Constitutional History of England*, vol. ii., p. 592.)

The first Tories opposed the Exclusion Bill and supported Charles II. in his endeavour to prevent a renewal of the attack upon his brother, by successive prorogations of the parliament. The origin of the name is referred by Roger North, a very hot Tory, in the following curious passage, to the connexion of the party with the Duke of York and his popish allies. 'It is easy to imagine how rampant these procurators of power, the Exclusioners, were under such circumstances of advantage as at that time prevailed; everywhere insulting and menacing the loyalists, as was done in all the terms of common conversation, and the latter had the wind in their faces, the votes of the House and the rabble into the bargain. This trade, then not much opposed, naturally led to a common use of slighting and opprobrious words, such as Yorkist. That served for mere distinction, but did not scandalize or reflect enough. Then they came to Tantivy, which implied riding post to Rome. Observe, all the while the loyal church party were passive, the outrage lay wholly on the other side. These observing that the Duke favoured Irishmen, all his friends, or those accounted such by appearing against the Exclusion, were straight become Irish; thence Bog-trotters, and in the *copia* of the factious language the word Tory was entertained, which signified the most despicable savages among the wild Irish; and being a vocal clear-sounding word, readily pronounced, it kept its hold, and took possession of the foul mouths of the faction, and everywhere as these men passed we could observe them breathe little else but Tory, together with oaths and damnations.' (*Examen*, p. 321.) Thus Dr. Johnson's first interpretation of *Tory* in his Dictionary is, 'A cant term, derived, I suppose, from an Irish word signifying a savage;' and Mr. Moore, in his 'Memoirs of Captain Rock,' sarcastically refers the history of the Tory party to a general 'History of the Irish Rogues and Rapparees.' The origin of the word Whig, which is a little younger than Tory, will be explained under Whig.

Dr. Johnson proceeds to give an explanation of the word *Tory*, which is perhaps as good a short general description of the principles of Toryism as is to be given:—'One who adheres to the antient constitution of the state, and the apostolical hierarchy of the Church of England.' Things as they have been, or, when some great change has taken place against the will of this party, things as they are,—the king before the aristocracy, and the aristocracy before the popular element in the constitution, which led the first Tories to argue from the divine right of kings for their exemption from parliamentary control, and for passive obedience, and which has afterwards directed their endeavours to contracting the suffrage so as to make the popular element as little popular as possible,—the freedom of the church from state control, while from the state it derives its sustenance,—and the fullest possible amount of political privilege and honour for the church, as distinguished from every other religious denomination,—these have been the cardinal characteristics of Toryism, from the beginning to the present time.

During the reigns of Charles II. and James II. the support of the king brought the Tories into a connexion with the Roman Catholics, which was inconsistent with their High Church views; and they were involved in a continual difficulty of reconciling their persecution of Protestant dissenters, with the favour they desired to show the Roman Catholics, as political partisans. Lord Bolingbroke has given the following description of Toryism at this period:—'Divine, hereditary, indefeasible right, lineal succession, passive obedience, prerogative, non-resistance, slavery, nay, and sometimes popery too, were associated in many minds to the idea of a Tory, and deemed incommunicable and inconsistent in the same manner with the idea of a Whig.' ('Dissertation on Parties,' *Miscellaneous Works*, vol. iii., p. 38, Edinburgh, 1773.) But popery was an accident to the creed of the party. The lengths to which James went for the Roman Catholic religion opened the eyes of the Tories; and the bulk of the party united with the Whigs in bringing about the revolution of 1688. The doctrines of divine right and passive obedience were now abandoned by the Tories in practice. During the reign of Anne they again raised their heads in argument, and the impolitic prosecution of Sacheverel gave force to their re-appearance. But from the Revolution down to the present time the struggle between the two parties, so far as it has been one of principle, has been a struggle by the Tories in behalf of the church, to invest it with political power and privileges, and against the increase of the power of the people in the state, through the House of Commons; and a struggle by the Whigs for the toleration of dissenters from the established religion, and for the strengthening of the popular element of the constitution.

The history of the Tory party, rising and falling in the state, may be traced in a series of articles in Knight's 'Companion to the Newspaper' for 1834, 1835, and 1836, entitled 'Changes of Administration and History of Parties;' or in Mr. G. W. Cooke's 'History of Party,' 3 vols. 8vo., which is on the whole a useful publication, though its accuracy is not to be implicitly depended on.

TOTANI'NÆ. [Scolopacidæ; Tringinæ.]

TO'TANUS, Cuvier's name for a genus of Wading-Birds [Grallatores], containing those snipe-like species known by the names of *Chevaliers*, &c. Example, *Totanus stagnatilis*. [Scolopacidæ, vol. xxi., p. 86.]

TO'TILA. [Rome.]

TOTIPALMES, Cuvier's name for a group of birds whose hind-toe is united together with the others in a continuous membrane. Notwithstanding this organization, which makes their feet more perfect oars, the *Totipalmata* are nearly the only Palmipede Birds that perch on trees. All fly well, and have short legs. The Pelicans, the Cormorants, the Frigate Birds, the Boobies, the Anhingas, and the Tropic Birds belong to this group.

TOTNESS, or TOTNES, a parliamentary borough in the hundred of Coleridge in Devonshire, 23 miles south by west of Exeter, the county town; 190 or 191 miles west-south-west of the General Post-Office, London, by Staines, Basingstoke, Andover, Amesbury, Wincaunton, Ilminster, Honiton, Exeter, and Newton Bushel; or 200 miles, namely, 166 miles by the Great Western and Bristol and Exeter Railways to Taunton (including the distance from the Post-Office to the London terminus), and from thence 34 miles farther by road through Wellington, Collumpton, and Exeter.

Totness is a place of great antiquity, and is mentioned by Risdon (*Survey of Devon*) as the place where Ambrosius and Uther Pendragon landed on their arrival from the Continent to oppose Vortigern. Risdon gives Bede as his authority, but we have not been able to trace the passage in the 'Historia Ecclesiastica' or other works of that writer. The name 'Totenes' occurs in some MS. of Nennius, c. iii. Totness is described in the Exon Domesday as a borough containing ninety-five burgesses within and fifteen without the borough: it was held by Junell de Totenais, or Toteneis, in both which ways the name is written. Juhell founded here a Cluniac priory, cell to the abbey of St. Sergius and St. Bachus at Angers: this priory was suppressed at the time of the general suppression of monasteries under Henry VIII., when its yearly revenues were estimated at 124*l.* 10*s.* 2½*d.* gross, or 24*l.* 9*s.* 2½*d.* clear. Juhell (or, as some call him, Judael) erected also a castle at Totness, and made it the head of his barony.

The area of the parish of Totness is 1170 acres: the number of houses, in 1831, was 404, viz. 375 inhabited by 731 families, 18 uninhabited, and 11 building: the population was 3442, a very small part agricultural. The town stands on the slope of a hill on the west side of the river Dart, over which there is a modern bridge of three arches: across the bridge, on the east side of the river, is a small suburb, in the manor of Bridgetown, in the parish of Berry Pomeroy: the manor of Bridgetown, which comprehends 241 acres, and had, in 1831, 78 houses and a population of 714, has, for parliamentary purposes, been added to the borough, giving it an area of 1411 acres, 482 houses, and a population of 4156. The town is partially lighted, and is watched by a private subscription: the houses are commonly white, with slated roofs: the principal street runs down the hill to the bridge, and is paved: several of the houses are antient, with upper stories projecting over the footpath, and supported by pillars: in the middle of the main street is an antient gateway, originally belonging to the town wall; and on an artificial mound of great elevation, commanding a fine view of the town and the surrounding country, is the circular keep of the antient castle. The church, which is on the north side of the town, behind the houses of the main street, is a handsome structure, with a well-proportioned tower, with pinnacles, at the west end. It contains a handsomely-carved stone screen, painted and gilded, and a plain stone pulpit: the altar-piece is of classical design, not in keeping with the Gothic architecture of the church. The church is built of a red stone, having the appearance of brick. There are meeting-houses for Independents, Unitarians, and Wesleyan Methodists. There are a guildhall and a small gaol, a small theatre, and an assembly-room.

There is no manufacture carried on at Totness, the serge manufacture, formerly carried on, having been given up; but it is a place of some trade, especially in corn, coal, and culm, which are imported, and in cider, which is exported. The river Dart is navigable for vessels of 100 tons up to the town: there is a salmon fishery in the river above the town. Many of the townsmen are seafaring men and fishermen. There is a weekly market on Saturday, a great cattle-market monthly, and two yearly fairs. Races are held yearly.

Totness received its first municipal charter from King John, but we have seen that it existed as a borough long before that time. The municipal borough comprehends the town, but not the whole parish. It has sent two members to parliament from the 23rd year of Edward I. The number of parliamentary electors, in 1835-6, was 312, viz. 280 10*l.*-householders and 32 freemen; in 1839-40, 341, viz. 311 10*l.*-householders and 30 freemen. By the Municipal Reform Act the borough has four aldermen and twelve councillors, but is not to have a commission of the peace except upon petition and grant. A more extended boundary, for municipal purposes, has been recommended.

The living is a vicarage, in the rural deanery and archdeaconry of Totton, or Totnes, and in the diocese of Exeter, of the clear yearly value of 200*l.*, with a glebe-house. There were in the parish, in the year 1833, three dame-schools, with 52 children of both sexes, and thirteen other day-schools; of which the grammar-school had two scholars on the foundation; the 'blue-coat school,' supported partly by endowment, partly by yearly subscription, 70 children; 'the national school,' 136 children; and eleven other schools, 339 children. There were also two Sunday-schools, with 262 children. Kennicott, the eminent Hebraist, and Lye, the Anglo-Saxon scholar, were natives of Totness.

(Risdon's *Survey of Devonshire*; Polwhele's *History of Devonshire*; Tanner's *Notitia Monastica*; *Clergy List*; Oldfield's *Representative History*; *Parliamentary Papers*.)

TOTT, FRANÇOIS BARON DE, the son of an Hungarian nobleman, who, obliged to leave his country in consequence of his connections with Prince Ragotzky, had entered the French service, was born at Ferté-sous-Jouarre, on the 17th of August, 1733. Young De Tott obtained at an early age a commission in the hussar regiment of Berchiny, which his father had been instrumental in raising and disciplining.

In 1755 the senior De Tott, who spoke the Turkish and Polish languages fluently, and had been more than once employed in missions to the Crimea, was appointed to accompany M. de Vergennes to Constantinople. He took his son with him, intending that he should study the language and render himself familiar with the manners of the Turks. The father died of a fever in September of the year 1757, but M. de Vergennes conferred upon the son an appointment in the embassy, which he continued to hold along with his commission in the regiment of Berchiny. De Tott remained at Constantinople till 1763, when he returned to France.

In 1766 the Baron de Tott presented a memorial to the Duc de Choiseul, pointing out the means of concluding a treaty of commerce with the Khan of the Crimea, and extending the commerce of France in the Black Sea. The French consul in the Crimea dying about the same time, the Duc de Choiseul appointed the memorialist his successor. De Tott repaired to his post by the way of Poland. He does not appear to have done anything towards realising his projects for placing the commercial intercourse of France with the Crimea on a better footing; but he contrived to involve himself so deeply in the intrigues of the court, that the vizir sought and obtained his removal by the French government in 1769.

The Baron de Tott returned to Constantinople, entered the service of the Ottoman Porte, and continued in it till the year 1776. If his own account may be believed, he was during that period one of the moving spirits of the Ottoman empire. He presented the Sultan with a map of the theatre of the war between the Turks and Russians immediately after his arrival at Constantinople; and suggested the advance of the Pasha of Bender into the Ukrain. He proposed an entire reform in the Turkish artillery, and was appointed to carry it into effect. In 1770 he was charged with the defence of the Dardanelles, menaced by the Russian fleet. In 1771 he devised a plan of defence for the Turkish frontiers towards Oczakow; taught the Turkish artillerists to make bombs, and brought them to an unprecedented dexterity in working their guns. In 1772 he organised a new cannon-foundry. In 1773 he gave directions for the fortification of the Black Sea mouth of the Bosporus. In 1773, 1774, and 1775 he was busy improving the fortifications and artillery of the Turks. All these statements have some foundation in fact; but the tone of exaggeration which pervades all the baron's account of his own exploits renders it impossible to decide how much of them is to be believed. It is evident that he did not think his services sufficiently appreciated, for in 1776 he tendered his resignation in disgust; and it is equally evident that they were not so highly esteemed by the Turks as by himself, for the resignation was readily accepted, and the baron dismissed with some cold compliments.

He was despatched by the French government in 1777 on a tour of inspection of the consular establishments in the ports of the Mediterranean from the Archipelago to the Barbary States. At the request of Buffon, Sonnini was allowed to accompany the expedition.

With this mission the diplomatic services of the Baron de Tott terminated. On his return to France he had two pensions settled upon him, one from the ministry of the marine, the other from that of foreign affairs, and, retiring from public life, occupied himself with preparing for the press the observations made during upwards of twenty years of active life. The work appeared in 1784 under the title 'Mémoires sur les Turcs et Tartares.' It met with great success: the original French version was frequently reprinted, and translations of it into English, German, Dutch, and Swedish appeared in the course of a few years.

De Tott was raised to the rank of Maréchal-de-camp in 1781. In 1786 or 1787 he was appointed governor of Douai. He held that office till 1790, but opposing himself to the republican fervour of the garrison, was nearly murdered and obliged to fly. He took refuge in Switzerland, where he resided for a year, and then proceeded to Vienna. He died in obscurity at Tatzmansdorf in Hungary, in 1793.

De Tott's memoirs, though vehemently attacked by Peyssonel, long retained their popularity. They are, as the earliest, so the least offensive of the crude and shallow speculations respecting Turkish politics with which Europe has of late years been inundated.

TOTTENHAM. [MIDDLESEX.]

TOUCANS. [RAMPHASTIDÆ.]

TOUCH. The sense of touch belongs to the outward integument of the body—the skin, and is shared, in a minor and modified degree, by parts of the mucous membranes, which, at the various orifices of the body, are continuous prolongations of the same structure. By it we have the faculty of determining our immediate relations to material objects, in regard of contact, temperature, and electrical excitement.

The nervous influence, or endowment, on which this sense depends, appears in no essential particular to be distinguished from that which gives common sensibility to the various deeper organs of the body. The nerves which convey the specific impressions of touch, are associated at their origin, or in their course, with others not reaching to the surface of the body, under the common name of *sensitive;* so that if we trace such a one from the centre outwards, we find it (previously to its termination in the skin, where it ministers to the special sense of touch) supplying parts which have merely that common feeling, or sensibility to pain, necessary to their own preservation. Examining, for instance, the course of the fifth cerebral nerve [Brain ; Nerve], we remark that its branches are partly distributed to cavities which are never exposed to foreign contact or to changes in temperature, whence accordingly they can convey to the sensorium only such unnatural impressions as originate in those cavities themselves, and attract attention by their painfulness. To the same class of nerves we likewise owe our immediate knowledge of weight and resistance; for, as they partly pass, together with the nerves of motion, to the voluntary muscles, they inform us of the vigour with which these contract, in order to balance or overcome any exterior force. Accordingly each trunk of a sensitive nerve transmits to the centre not only the specific impressions of contact, temperature, or electrical shock, which may affect its cutaneous extremities; but likewise, by the excitement of pain, makes us aware of deviations from healthy function, and, by the so-called *muscular sense*, measures for us our own particular exertions of force.

These intermediate distributions of a sensitive nerve, then, do not suffice as a provision for the special sense, which is peculiar to tegumentary parts: they create only a vague and general sensibility.

In order to that high development of the sense of touch, which we notice in the human hand, or in the proboscis of the elephant, certain anatomical peculiarities are required, viz.:—

1. An exposure of the largest possible number of points, each endowed with sensibility, and capable of being recognised in the sensorium, as distinct and individual. Such a structure is eminently illustrated in the papillary surface of the skin; which presents a vast number of minute evolutions, or *papillæ*, every one furnished with its own fibrillary nervous loop, and a minute inosculation of blood-vessels. It is certain that each terminal loop is represented by a definite point in the brain, that no two nervous fibrillæ become blended or confused, and hence that each papilla may originate a single and particular sensation. Perhaps the strongest familiar evidence that can be adduced for this fact, is furnished in the tingling sensation (called 'pins and needles') which we produce in numbing the nerve of a part by pressure; the impression here made on the trunk of a nerve being referred, according to a well-known physiological law, to its cutaneous extremities; so that when, for example, we strike the *funny-bone*, or otherwise press the ulnar nerve which lies there, the peculiar tingling is felt in the skin, at the tips of the last two fingers: if this sensation be analysed, we find it to consist in a pricking of innumerable minute points, as though there were falling on the part a quick dense shower of the finest needles: the minute points, so made sensible to us, are single papillæ of the skin. This instance of subjective sensation is probably the only mode in which the sensitive faculty of the skin can be made known to us; for obvious reasons prove it impossible to apply to the organs of touch the same precise admeasurements as we may use in ascertaining the power of the eye or of the ear. It appears however that the tactile power of the skin varies for different parts in a very much greater degree than can be accounted for by differences in nervous supply. Professor Weber has measured the power of distinguishing distances in different parts of the skin, with the view of affording means to compare their relative degrees of endowment. He conducted his experiments by touching the surface with the points of a pair of compasses (blunted with pieces of cork), and observing how close their arms might be brought together, and still be felt each distinctly. He found that the point of the tongue could distinguish them, as two impressions, when distant only half a line from each other; and that in the middle of the back a separation of thirty lines was necessary to the distinction. Thus, while the tactile endowment of a part is in proportion to the minuteness and density of its papillation, it is evident that the applicability and development of this property will depend on habit and attention and practice, by which we acquire the power of appreciating minute differences of impression. It seems established in regard of the organ of sight, that the smallest anatomical divisions of the retina—those, namely, which are analogous to the papillæ of the skin—accurately correspond to the limits of distinct vision, each being capable of receiving and conveying from without a particular and separate sensation. The intervention of the epidermis, or scarf skin, hinders the sense of touch from possessing equal perfection; it is impossible, by reason of this scaly covering to impress any single papilla, without simultaneously affecting its nearer neighbours: yet is there marvellous compensation and balance of advantages in that exquisite construction of the human hand, which permits to the chief organ of our bodily acts,—with the strength and excellence of mechanical adjustment, that render it our first tool and instrument,—a sensibility so delicate, that it can appreciate the dimensions of a line.

2. In addition to the anatomical arrangement just described, the sense of touch requires for its perfection that a *muscular apparatus* should be connected with the sentient surface, by means of which this may adapt itself to the superficies of bodies, in order to explore their outlines, span their dimensions, or probe their texture. And we find accordingly in those organs which are most tactile,—the hand, the tongue, the lips of the human subject, the snout, proboscis, or tentacles of lower animals,—that complicated muscular motions belong to the part, and render it a more available instrument of exploration. The importance of this addition becomes manifest, if we apply a foreign object to any plane surface of the body (to the front of the fore-arm, for instance), and hold it there without pressure or motion. The only sensation so conveyed is one of indefinite contact: without pressure we know not its consistence; without successive and exploring movement we cannot ascertain its outline or level.

The sense of touch is trained to its highest perfection in those who are born blind, and who from early childhood have acquired the habit of making this sense supplemental to the absent one. In them the faculty of distinguishing minute differences in impression, and of receiving from a given surface of integument the largest number of separate sensations of contact, appears most remarkably developed; and in them too the exploring movements of touch are performed with most skill and delicacy. To such an extent is this the case, that many have believed the blind to have some means of appreciating colour. This they have not; but they are probably able to detect by touch certain differences of texture—which depend on the chemical processes of dyeing, or on other circumstances of preparation—in the materials they handle, and may perhaps associate and classify these accordingly under the names of colour supplied to them by their teachers: more than this it is impossible they should perform.

TOUCH-ME-NOT. [Impatiens.]

TOUCHSTONE. [Flinty Slate.]

TOUL. [Meurthe.]

TOULMIN, JOSHUA, D.D., was born in London, 11th May, 1740, and was educated at St. Paul's school, whence he was removed to what was then called the Dissenting Academy, the classes constituting which were taught in Wellclose Square, in the house of his relation Dr. Samuel Morton Savage, who was the classical and mathematical tutor; the only other teacher being Dr. David Jennings, who was theological tutor or professor, and presided over the seminary. (*History of Dissenters*, by Bogue and Bennett, iv. 261, 262.) On being licensed to preach, he was in the first instance settled as minister of a dissenting congregation at Colyton in Devonshire. At this time his principles appear to have been what are commonly called orthodox; but he soon became a convert to the pinions of the Baptists; upon which, in 1765, he transerred himself to Taunton, where, besides having the harge of a Baptist congregation, he taught a school, and lso, it is said, kept a bookseller's shop. It was while resident here likewise that he wrote and published most of he literary works which have made his name known. He had not been long at Taunton before his theology underwent a further change; but, although he had previously received invitations from the Unitarians both of Gloucester and Yarmouth, he remained where he was till 1804, when he accepted the situation of one of the pastors of the Unitarian congregation at Birmingham, formerly presided over by Dr. Priestley, and then assembling in what was called the New Meeting-House. This appointment he continued to hold, discharging its duties with much acceptance, till his death at Birmingham, after a short illness, on the 23rd of July, 1815, leaving five children, out of a family of twelve, by his wife Jane, youngest daughter of Mr. J. Smith, of Taunton, whom he married in 1764. His eldest son was for some time minister of a Baptist congregation at Chewbent, in Lancashire, but afterwards went to America.

Dr. Toulmin received his diploma of D.D. from Harvard University, in the United States, in 1794. His first publication appears to have been an octavo volume, entitled 'Sermons addressed to Youth, with a Translation of Isocrates's Oration to Demonicus,' which appeared in 1770, and was reprinted in 1789: this was followed by 'Two Letters on the Address of the Dissenting Ministers on Subscription,' 8vo., 1774; 'Memoirs of Socinus,' 8vo., 1777; 'Letters to Dr. John Sturges on the Church Establishment,' 8vo., 1782; 'Dissertations on the Internal Evidences of Christianity,' 8vo., 1785; 'Essay on Baptism,' 8vo., 1786; a new edition (the third) of 'Mr. William Foot's Account of the Ordinance of Baptism,' 8vo., 1787; 'Review of the Life, Character, and Writings of John Biddle, M.A.,' 8vo., 1789; 'History of the Town of Taunton,' 4to, 1791; a new edition of Neal's 'History of the Puritans,' with notes and additions, 5 vols. 8vo., 1794-97, reprinted in 3 vols. 8vo., 1837; 'Biographical Tribute to the Memory of Dr. Priestley,' 8vo., 1804; 'Addresses to Young Men,' 12mo., 1804; 'Memoirs of the Rev. Samuel Bourne' (his colleague at Birmingham), 8vo., 1809; 'Sermons on Devotional Subjects,' 8vo., 1810; 'Historical View of the State of the Protestant Dissenters in England,' 8vo., 1814; besides a number of single sermons and other pamphlets: and he was also an occasional contributor to the 'Theological Repository,' 'The Nonconformists' Memorial,' 'The Monthly Magazine,' and other periodical publications. Dr. Toulmin's writings, without much either of learning or power of thought, display generally an agreeable perspicuity and neatness of style, rising sometimes to considerable energy and animation; and although steady, and even eager, in the defence of his own opinions, he states what he has to say without any bitterness or discourtesy to his opponents. He appears to have been a somewhat narrow-minded but conscientious and kind-hearted man.

TOULON, a town in France, on the coast of the Mediterranean, capital of an arrondissement in the department of Var, 428 miles in a direct line south-south-east of Paris, or 520 miles by Melun, Sens, Auxerre, Autun, Châlons-sur-Saône, Mâcon, Lyon, Vienne, Valence, Orange, Avignon, Aix, and Cujes: in 43° 6′ N. lat. and 5° 56′ E. long.

Toulon existed in the time of the Romans, and is noticed as a harbour in the 'Itinerarium Maritimum' of Antoninus, under the name of 'Telo Martius.' It is noticed also by the anonymous geographer of Ravenna, who calls it simply 'Telo;' and from the 'Notitia Dignitatum per Gallias,' which enumerates among other officers the 'Procurator Baphii Telonensis Galliarum' ('Overseer of the dye-house for the provinces of Gaul at Toulon'), it appears that the principal government dye-house in Gaul was here. (Bouquet, *Recueil des Historiens des Gaules et de la France*, tom. i.) A bishopric was established here in the fourth century, which continued till the Revolution: the bishop was a suffragan of the archbishop of Arles.

In the middle ages Toulon was repeatedly ruined by the Saracens, and as often recovered from the disaster. Louis XII., to protect it from the pirates of Barbary, commenced the erection of a large tower, which was completed by François I. In the year 1536 it was taken by the Constable of Bourbon, then commanding the Imperial army. Henri IV. strengthened the fortifications of the town, and formed a harbour for merchant vessels. Louis XIV., designing to make it one of the barriers of France on the side of Italy and the Mediterranean, established the royal dockyard, and caused the whole town to be fortified by Vauban. It was attacked without success in 1707 by the duke of Savoy by land, at the head of a formidable army, and by the combined English and Dutch fleets by sea. In 1793 it was occupied by a detachment of marines from the English and Spanish fleets then cruising off the port, through an understanding with the Royalists in the town; and was subsequently garrisoned by a strong force of the English and their allies and of the French Royalists. It was soon besieged by the French, Carteaux first, and afterwards Dugommier having the command in chief, and the artillery being directed by Napoleon Bonaparte, whose celebrity had its commencement here. The capture of General O'Hara, the commander of the garrison, and the taking of Fort Eguillette, on a point of land between the inner and the outer road, obliged the allies to evacuate the town, after burning the arsenal and carrying away or burning nearly all the vessels in the harbour. Many of the Royalists escaped on board the allied fleets; but some remained, several of whom were put to death by the victorious Republicans. The town, in consequence of its having been given up to the allies by the townsmen, lost its rank of capital of the department, which has never been restored.

Toulon is open on the south side to the harbours and road, but is sheltered on the north by the lofty Mount Pharon, and on the east and west by hills of less elevation: from its position, the heat in summer is intolerable. The road is an inlet of the Mediterranean, having its opening towards the east; and is divided into two parts, the inner and the outer road, by two headlands, which extend into the road on each side so as to form a narrow strait: on the north side of the inner road are the two harbours, 'Le Vieux Port,' or 'Le Port Marchand,' on the east, constructed by Henri IV.; and on the west 'Le Port Neuf,' for the navy, constructed by Louis XIV. North of these two harbours is the town. These two inner harbours are separated from the inner road and from each other by moles or piers: they have each a narrow entrance, passable only by one vessel at a time; and there is a passage communicating between the two with a swing-bridge. 'Le Vieux Port,' or 'Old Harbour,' is surrounded by a large and tolerably handsome quay, along which, on the north or town side, are a number of good houses. 'Le Port Neuf,' or 'New Harbour,' is surrounded by the various buildings connected with it as a naval port. On the north side are the dockyard and arsenal, containing the various storehouses for the navy; covered slips for building vessels; the sailmakers' and other workshops; the armories, in which is a fine collection of antient arms; the naval-school, with a fine library and a collection of models of vessels of every kind; the school of naval artillery; the navigation-school; and, on the north side of the dockyard, the rope-manufactory, nearly 1700, or, according to some accounts, above 2000 feet long, built of freestone, from the designs of Vauban, with a vaulted roof. On the east side of the naval port, and at the eastern extremity of the south side, are the bagne or convict-house, and the hospital for convicts: they are built on the moles which enclose the harbour, and usually contain from 4000 to 5000 convicts. In the same quarter are three basins for the construction or repair of vessels. The depôt or park of artillery is on the west side of the harbour, and is enclosed in one of the bastions of the town. Both town and harbours are surrounded, except toward the road, by a wall, strengthened by bastions and by a ditch. Without the ditch, on the west side, adjacent to the dockyard, is the government bake-house. The town is entered by two gates, the gate of France on the north-west, through which the road from Paris, Aix, and Marseille passes; and the gate of Italy on the north-east, through which the road from Genoa, Nice, and Fréjus enters. Adjacent to the town, on the north side, is a walled enclosure, called the entrenched camp of St. Anne: a great number of detached outworks occupy various positions round the town, and are considered to form so well arranged a system of defence, that the place is regarded as impregnable. The depôt or park of artillery for the land service occupies one of the bastions on the north side of the town; and there are handsome barracks. The Champ de Mars, or exercise ground, is on the north-east side, without the walls.

The older part of the town is in the centre, and is surrounded on the north and east by a wide street (Le Cours and Rue Lafayette), or boulevard, apparently occupying the site of the old town-wall: beyond this, but within the present town-wall, are streets whose regularity indicates their modern origin; and on the west side of the old town, and north of the dockyard, are other new streets regularly laid out. The streets are tolerably well paved, and the houses tolerably well built; and a number of fountains tend to keep the town clean: there are some 'places,' or squares, but all small, except the Place d'Armes or Parade.

Toulon has the ex-cathedral of Notre Dame, and three other parish churches, St. Jean, St. Pierre, and St. Louis. Notre Dame is a small and gloomy building; but is decorated by several works of the sculptor Puget. The front of the church of St. Louis has a tolerably good colonnade. Adjacent to the church of Notre Dame is the college or high school, which is a good building. There are a marine hospital, a military hospital, a foundling and another hospital; the ex-episcopal palace; the office of the maritime prefect, forming one side of the Place d'Armes; a small and inconvenient palais de justice or court-house; an exchange; a town-hall, on the quay of the old or mercantile port; a theatre; and several bathing establishments. Some of these are outside of the walls of the town. There are a public library of 8000 volumes, a medical library, a valuable museum of natural history, a botanic garden, an observatory established in the naval hospital; a society of belles lettres, sciences, and arts; courses of instruction in geometry and practical mechanics; a savings' bank, a mont-de-piété, and a maternity society. The lazaretto is on the south side of the outer road, at some distance from the town.

The population of the commune, in 1831, was 28,419 (of whom 24,121 were in the town itself); and in 1836, 35,322. The business of the place, independent of the government establishments, is not very great. There are some soap-houses; some coarse woollens, morocco leather, chocolate, vermicelli, and candles are manufactured; and some merchant vessels are built. Trade is carried on in wine, brandy, oil, olives, dried fruits, corn, flour, and other productions of the neighbourhood. There are two yearly fairs of eight days each. The townsmen were formerly reputed to be the roughest in Provence: hence arose the proverb, characterizing the manners of this and the other chief towns, 'Aix in Provence, Marseille in Turkey, Toulon in Barbary.' The low grounds in the neighbourhood are fruitful; they produce excellent vegetables, besides figs, olives, oranges, grapes, and capers.

Toulon ranks as the second naval port in France, and is the residence of a number of officers connected with the administration of the naval department. There are also several fiscal government offices. It has three courts of justice, namely, a tribunal de première instance, a tribunal de commerce, and a tribunal de marine.

The arrondissement of Toulon has an area of 500 square miles and comprehends twenty-eight communes: it is divided into eight cantons or districts, each under a justice of the peace: the population, in 1831, was 94,242; in 1836 it was 99.012.

(Vaysse de Villiers, *Itinéraire Descriptif de la France;* Malte-Brun, *Géographie Universelle;* Millin, *Voyage dans les Départemens du Midi de la France; Dictionnaire Géographique Universel; Statistique de la France.*)

TOULONGEON, FRANÇOIS E'MANUEL, VISCOUNT OF, a French historian of the last and present century, was born A.D. 1748, at the castle of Champlitte, in La Franche Comté, and belonged to one of the oldest families in that province. He was destined by his parents for the church, and was sent at an early age to the seminary of St. Sulpice at Paris; but having evinced a decided repugnance to theological studies, he was permitted to follow his own inclination, and to enter the army. He was a great admirer of Voltaire, to whom, A.D. 1776, he paid a visit at Ferney, and whose favour he gained. He was admitted a member of the Académie of Besançon, A.D. 1779, having previously manifested a degree of poetical talent which gained for him some local celebrity. He rose to the rank of colonel of chasseurs, and his regiment was remarked for its discipline and good condition; but he quitted the service previous to the wars which arose out of the French revolution. At the commencement of the revolution he embraced the popular side, and defended it against the majority of the nobles of La Franche Comté in the assembly of the states of that province, held at Quingey, A.D. 1788. He published about this time a pamphlet, under the title of 'Principes Naturels et Constitutifs des Assemblées Nationales.' This, which appears to have been his first publication, gained him considerable popularity, and led to his appointment as one of the deputies of the nobility of the province in the States-General of 1789. He was one of those nobles who separated themselves from their order to unite with the tiers-état, or commons, in one chamber, which assumed the title of the National Assembly. In the years 1790-91 he acted with the moderate revolutionists; and at the close of the session, presaging the approaching troubles, he quitted public life, and retired to an estate which he possessed in Le Nivernais, the sole remain of his patrimonial inheritance, and which was considerably diminished in value by the loss of the feudal services which had been suppressed at the revolution. His early retirement preserved him from the perils of the reign of terror. His subsequent life was devoted to literary and to agricultural pursuits. He was elected a member of the Institute, A.D. 1797, in the class of the moral sciences (a class suppressed at the reorganization of the Institute, A.D. 1803); and, in the same year, brought out a periodical, entitled 'L'Esprit Public,' with the view of calming the violence of party spirit; but only six numbers of the work appeared. He was chosen, A.D. 1802 and 1809, deputy for the department of Nièvre in the legislative body; and was subsequently made a commander of the Legion of Honour. He died suddenly, 23rd December, A.D. 1812, and was buried in the cemetery of Montmartre, where his children have raised a monument to his memory.

The principal works of Toulongeon are:—'Histoire de France depuis la Révolution de 1789;' 'Manuel du Muséum Français;' 'Manuel Révolutionnaire, ou Pensées Morales sur l'Etat Politique des Peuples en Révolution,' a poem, entitled 'Recherches Historiques et Philosophiques sur l'Amour et le Plaisir;' and a translation of Cæsar's 'Commentaries.' He published some smaller works; and some of his papers read at the Institute were published either in the 'Mémoires de l'Institut,' or separately, by himself. His 'Histoire de France' never appears to have attained a high reputation, and has been superseded by later histories of the same period; but the exactness of its military details gives it some value. The first edition was without date, in 2 vols. 8vo.; the second edition (A.D. 1801-1810) was published in 4 vols. 4to., or 7 vols. 8vo., with maps and plans of battles. The 'Manuel du Muséum' is a catalogue raisonné of the paintings of the antient masters: it was published in ten thin volumes, 8vo., A.D. 1802-8: the first nine volumes have the initials of Toulongeon on the title-pages; the tenth volume is by another hand. The 'Manuel Révolutionnaire' (A.D. 1796) went through two editions, and was translated into German. The translation of Cæsar was published after Toulongeon's decease (A.D. 1813), in 2 vols. 18mo., with plans and military notes on the text. A new edition, interpaged with the original text, was published A.D. 1826: part of a collection (by M. A. Pommier) of the Latin classics, interpaged with French versions.

(*Biographie Universelle; Biographie des Contemporains;* Quérard, *La France Littéraire.*)

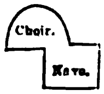
TOULOUSE, a city in France, formerly capital of the province of Languedoc, and now the chief town of the department of Haute Garonne, 363 miles in a direct line south by west of Paris, or 438 miles by the road through Orléans, Châteauroux, Limoges, Cahors, and Montauban, in 43° 35′ N. lat. and 1° 26′ E. long.

The notices of this town in antient writers are more numerous than of most towns in Gaul, and relate to an earlier period: the name was written by the Greek writers Strabo and Ptolemy Τολώσσα, Τολῶσα, and Τόλοσσα; and by the Latin authors and in inscriptions Tolosa and Tholosa. By a similar variation to this last the name has been written in later times Toulouse and Thoulouse, but the *h* is now generally omitted. In the time of the Gauls this city, which belonged to the Volcae Tectosages, a Celtic nation, contained an enormous treasure in gold and silver which was seized by the Romans under Caepio, B.C. 106. As the treasure had been deposited in consecrated places, the seizure of it was regarded as sacrilege; and the misfortunes which afterwards overtook the perpetrators occasioned 'the gold of Toulouse' ('aurum Tholosanum') to become a proverbial expression for treasure which brought ruin upon its owners. (Aulus Gellius, *Noctes Atticae*, III. ix.) Toulouse was afterwards subject to the Romans, the Visigoths, and the Franks, and in the middle ages had counts of its own, who were potentates of great importance in the south of France. [LANGUEDOC.] The last historical event of importance connected with it was the battle fought, 10th April, 1814, between the allied army under the duke of Wellington, and the French under Marshal Soult. The English were victorious, and Soult was obliged to evacuate the town.

Toulouse is situated on the right or east bank of the Garonne, which, flowing from the south, bends westward, forming a crescent, on the concave side of which the town stands. As the Canal du Midi, or Canal de Languedoc, which unites the Garonne with the Mediterranean, opens into the river a short distance below the town, and has its course for some distance parallel to the river, the site of the town and its suburbs is a peninsula, enclosed between the Garonne, close to the town, on the west, and the canal at a little distance on the north and east. On the south side, but at some distance, are the heights of Pech-David; and on the east, beyond the canal, and between it and the little river Lers (which flows parallel to the canal, and falls into the Garonne below it), are the heights of Mont Rave, on which the fiercest part of the battle of Toulouse, in 1814, took place.

The town and the suburb of St. Cyprien, which is on the opposite bank of the river, are enclosed by walls, erected in the middle ages, and are united by a bridge of seven arches, the Pont Neuf, about 860 feet long, erected under Louis XIV., from the designs of Souffron, which crosses the river in the middle of the bend. The river is lined with handsome quays. The walls (which have nine gates) appear to have been, in 1814, tolerably entire, and 'so thick as to admit sixteen and twenty-four pound guns' (Napier, *Peninsular War*); but later authorities describe them as gradually disappearing in the progress of improvement. Beside St. Cyprien, there are several faubourgs or suburbs: Bazacle, on the north-west, close to the river; Arnaud-Bernard, on the north; Matabiau, on the north-east; St. Etienne and Guillemérie, on the east; and St. Michel, on the south: the faubourgs Arnaud-Bernard, Matabiau, and St. Etienne, extend to the Canal du Midi; and Guillemérie lies beyond the canal, adjacent to St. Etienne. On the south-east side of the town, between St. Etienne and St. Michel, is the Esplanade, a circular space surrounded by trees, planted so as to form four concentric circles, and having six avenues radiating from it, each with four rows of trees, forming three alleys. The streets of the town itself were, till of late years, narrow and crooked; the squares irregular in form, the houses built of brick, and few of the edifices of a handsome appearance (Millin, *Voyage dans les Départemens du Midi*, A.D. 1811); but improvement has latterly been very rapid. The town is still however as it were in a state of transition: 'its streets, commonly narrow and crooked, become still more irregular, as in taking care to give them a better direction, old houses are replaced by others arranged upon a new line; so that, with some exceptions, the streets present only houses, some protruding and some receding.' (Malte-Brun.) They are paved with round stones, very fatiguing for foot passengers. The old houses are generally covered with stucco. 'The squares are still unfinished, but they show what they will be when completed' (Ibid.): the Place Royale, Place St. George, and Place Angoulême are the handsomest. Ten or more fountains and a hundred 'bornes fontaines,' or fountains issuing from walls, serve to cleanse and refresh the streets. Many of these fountains owe their erection to M. Montbel, formerly mayor of the city, and afterwards one of the ministers who signed the unlucky 'ordonnances' of Charles X.: especially he erected one of white marble in the Place Royale, adorned with bas-reliefs of events in the Spanish campaign of 1823.

The principal public buildings are the cathedral, the capitol or Hôtel de Ville, the ex-archiepiscopal palace, and the church of the Grands Augustins, now occupied as a museum. The nave and portal of the cathedral are more antient than the choir, and are described by Malte-Brun as belonging to 'an old heavy Gothic church:' the choir, erected in the sixteenth century as part of a new edifice designed to replace the older one, but which has never been finished, is described by the same author as one of the most beautiful in France. In receiving the judgment of Malte-Brun regard must be had to the difference of architectural taste in England and France. The choir is not in a line with the nave; so that the whole structure has a very irregular figure, somewhat like this.



In the tower of the Cathedral is 'the bell of Cardaillac,' weighing 50,000 lbs. French. The town-hall or capitol is almost entirely a modern building, erected on the site of a more antient one. It has a front of about 380 feet long by 128 high, and is of most imposing appearance. The court is shown in which the duke of Montmorency is said to have been beheaded, A.D. 1632, and which must therefore be a remain of the older building. A gallery termed 'Galerie des Illustres,' is set apart for busts of those persons, natives of the city or connected with it, whom the town has thought worthy of the honour of a place. The ex-palace of the archbishop, now occupied by the prefect of the department, is the handsomest modern building after the capitol. The museum in the cloister and church of the Grands Augustins contains a number of antiquities, which have been collected in the department. Besides these edifices may be noticed the theatre; the new court-houses for the Cour Royale and the tribunal de première instance; the veterinary school; the church of La Dorade, built on the site of an antient heathen temple, and that of St. Saturnin, the interior of which is very impressive; the vast hospitals of the Hôtel Dieu and St. Joseph-de-la-Grave; the mill of Bazacle; the abattoirs; and the bridge and bas-relief at the junction of the Canal du Midi and the Canal de Brienne. This latter canal, which is very short, connects the Garonne at the mill of Bazacle, adjacent to the town wall, with the Canal du Midi. In the Ile de Tonnis, a small island in the Garonne opposite the town, and indeed forming part of it (for the island is covered with buildings), are the ruins of the Castle of Narbonnais, the former residence of the counts of Toulouse. Toulouse has scarcely any remains of Roman buildings. There are a large public garden; a botanic garden, rich especially in plants from the Pyrenees, and in exotics, where courses of instruction in botany are given; and a public walk, 'Cours Dillon,' in the Faubourg St. Cyprien, on the bank of the Garonne.

The population of the commune of Toulouse in 1826 was 55,319; in 1831, 59,630; and in 1836, 77,372. There are bell-foundries and copper-mills, a very large manufactory of sickles, files, and other hardwares, and a number of establishments for different branches of the iron-manufacture; printing-offices, oil-mills, brandy distilleries, breweries, dye-houses, tan-yards, rope-walks, flour-mills; manufactories of wax, wax-candles, paper-hangings, oil-cloth, musical strings, morocco leather, cotton and woollen yarn, blankets, cotton counterpanes, printed cottons, hats, straw-hats, earthenware, porcelain; and a government snuff-manufactory. Trade is carried on with Spain, with the ports of Bordeaux and Marseille, and with the interior: the Spanish trade is the most important. The chief export is of wheat and flour, the produce of the surrounding country, which was eminent for its productiveness in corn as early as in the time of Cæsar (*De Bell. Gall.*, i. 10). Toulouse is celebrated also for its ducks' liver pies, of which a great number are sent to other parts of France. There are two great markets in the year for flowers and salt pork; and eight fairs, including four of eight days each, and two of three days; one of the eight-day fairs is an important fair for wool and woollen cloth.

Toulouse is the chief town of the department; it is the seat of a Cour Royale, whose jurisdiction comprehends the departments of Arriège, Haute Garonne, Tarn, and Tarn et Garonne, and of an Académie Universitaire, which has authority over the same departments: it is the head-quarters of the tenth military division, comprehending the departments of Aude, Pyrenées Orientales, Arriège, Haute Garonne, Hautes Pyrenées, Gers, and Tarn et Garonne. It has an assize court, a chamber of commerce, a tribunal of commerce, a tribunal de première instance, or subordinate court of justice, a mint, and several fiscal government offices. There are a royal cannon foundry, an arsenal, and an artillery school.

The archbishopric of Toulouse originated as a bishopric in the third century; St. Saturninus, the first bishop, is said to have suffered martyrdom A.D. 250; it did not attain to its metropolitan rank till the fourteenth century. It is now united with the archbishopric of Narbonne, to which its bishops were antiently suffragans; the style of the prelate is archbishop of Toulouse and Narbonne. The diocese includes the department of Haute Garonne, and the archbishop's suffragans are the bishops of Montauban, Pamiers, and Carcassonne.

Toulouse is distinguished by the attention of the townsmen to literature. It possesses a number of establishments for public instruction: its schools include 2000 students; and there are several learned societies which distribute prizes. The most eminent of these is the Académie des Jeux Floraux, which distributes prizes for the best poems; the prizes, which are golden flowers, are open to the competition of all France. This society originated in the middle ages, probably in or before the thirteenth century; certainly not later than the fourteenth; and appears to have been an association of trouvères, or troubadours. The poetical contests held by the society, and known as the Jeux Floraux, are thought to have been revived from the neglect into which they had fallen by Clémence Isaure, a young lady of family, who devoted her property to form a perpetual endowment for these 'games,' or annual poetical contests, which are still kept up. There is an antient statue of Clémence in the Galerie des Illustres, but the epoch at which she lived is not ascertained. There are an academy of inscriptions, sciences, and belles-lettres; an academy of painting, sculpture, and architecture; a royal college or high school, a seminary for the priesthood, a secondary school of medicine and surgery, a school of arts and trades, a drawing-school; a royal riding, music, and singing school; courses of instruction in geometry and practical mechanics; on experimental philosophy, chemistry, and midwifery, at the Hôtel Dieu; and societies of medicine, of the fine arts, and of agriculture. There are two public libraries, one of 30,000, the other of 24,000 volumes: one of these (attached to the college) has the prayer-book (les Heures) of Charlemagne, written in golden letters on vellum, given by that prince to the Abbey of St. Sernin, A.D. 778. There are (or were lately) eleven printing-offices, twenty-three booksellers' shops: two political journals, and nine devoted to literature and the sciences, are published. There are a botanic garden, a departmental nursery, and an observatory, where courses of instruction on astronomy are given.

There are a society of maternal charity, a Protestant Bible Society, and a society for granting loans on security without interest; two hospitals, an orphan asylum, and six maisons de secours, or houses for the relief of the destitute.

The arrondissement of Toulouse has an area of 612 square miles; and comprehends 138 communes; the population, in 1831, was 139,927; in 1836, 159,064. The arrondissement is divided into twelve cantons or districts, each under a justice of the peace.

(*Dictionnaire Géographique Universel;* Millin, *Voyage dans les Départemens du Midi;* Malte-Brun, *Géographie Universelle.*)

TOULOUSE, COUNTS OF. [LANGUEDOC.]

TOUP, JONATHAN, was born at St. Ives in Cornwall, in December, 1713, and was partly educated at a grammar-school in that town. He was afterwards entered at Exeter College, Oxford, where he took his bachelor's degree, but his master of arts degree he took at Cambridge. Toup entered the church, and obtained successively the rectory of St. Martin's, Exeter, and a prebend's stall in Exeter cathedral. He died on the 19th of January, 1785, in his 72nd year, and was buried in St. Martin's church.

Toup was an accurate scholar, and one of the best English critics in the middle of last century. The work by which he is best known is his 'Emendations of Suidas;' the first volume of which was published in 1760, under the title of 'Emendationes in Suidam, in quibus plurima loca veterum Græcorum, Sophoclis et Aristophanis imprimis, cum explicantur tum emendantur.' This was followed by two volumes more in 1764 and 1766, and by a fourth in 1775, under the title of 'Appendiculum Notarum in Suidam.' This work gained for him the friendship of Bishop Warburton, to whose influence Toup was mainly indebted for his church preferment. In 1767 Toup published his 'Epistola Critica ad virum celeberrimum Gulielmum episcopum Glocestriensem,' containing various corrections and explanations of many passages in the Greek authors. Toup was also a large contributor to the Oxford edition of Theocritus edited by Wharton, which was published in 1770. A note of his upon the fourteenth Idyl was cancelled by the vice-chancellor on the ground of its indecency, principally, it is said, at the wish of Dr. Lowth. Toup, however, was highly displeased at this, and published the objectionable note in 1772 in his 'Curæ Posteriores, sive Appendicula Notarum atque emendationum in Theocritum, Oxonii nuperrime publicatum,' in which he attacks the taste and the learning of those who had it omitted. Toup's last work was an edition of Longinus, published at Oxford in 1778, and reprinted in 1789, which is still one of the best editions we have of this writer.

(Nichols's Bowyer.)

TOUR, MAURICE QUENTIN DE LA, an eminent French portrait painter, born at St. Quentin in 1704. De la Tour was distinguished for his portraits in crayons, which he executed the size of life; he painted very slowly and finished very highly, but gave his pictures the appearance of having been executed with great ease by adding a few bold and effective touches to the already finished work. He painted many portraits, and was much in fashion in the time of Louis XV., with whom he was a favourite, and whose portrait he painted. The following are among his best pictures:—a large full-length of Madame de Pompadour; the portrait of Louis, Dauphin of France; one of Prince Charles, the Pretender; and portraits of Restout, the king's painter, presented to the Academy of Arts of Paris in 1746, when De la Tour was elected a member of the Academy; of Réné Fremin, the king's sculptor; of J. B. S. Chardin, the painter; of the Maréchal de Saxe, and others; and his own portrait, which was engraved by G. F. Schmidt in 1742.

De la Tour was a man of very eccentric habits, and towards the end of his life he grew silly, and spoiled many of his works by painting out the beautiful accessories which he had originally introduced, upon the principle that in portrait everything should be sacrificed to the head—the portrait of Restout was one that suffered in this way: he turned his brilliant silk vest into one of simple brown stuff. He died in 1788, aged 84. He gave 10,000 francs to the Academy of Paris to found an annual prize of 500 francs for the best picture in perspective, aërial and linear alternately; he gave also an equal sum for the foundation of an annual prize for the most useful discovery for the arts, to be awarded by the Academy of Amiens; and he founded a gratuitous school of design in his native place, St. Quentin.

(Watelet et Levesque, *Dictionnaire des Arts, &c.*; *Biographie Universelle.*)

TOURACOS. [MUSOPHAGIDÆ, vol. xvi., p. 29.]

TOURCOING, a town in the department of Nord, in France, about six miles north-east of Lille and 146 north-north-east of Paris. The town is well laid out and well built, and has a large and handsome square, called La Grande Place. There are two churches, those of St. Christophe and St. Jacques, and a town-hall and the remains of an antient castle. The town is supplied with water by Artesian wells. The population of the town, in 1831, was 8094; of the whole commune, 17,973. The manufactures of the town are important and of early origin, having acquired some celebrity in the twelfth century: they comprehend cotton and woollen yarn, swan-skin, camlet, table-linen, a variety of fabrics of wool and cotton, carpets, and soap. There are dye-houses, tan-yards, and brick-yards. There are two yearly fairs, one of which continues nine days. There are a chamber of manufactures, a council of prud'hommes, a college, and an hospital or almshouse for old women.

(*Dictionnaire Géographique Universel;* Dupin, *Forces Productives de la France.*)

TOURMALIN. *Schorl.* This mineral occurs crystallized. Primary form a rhomboid; secondary forms, prisms with from three to twelve sides, terminated by very irregular summits. Cleavage parallel to the faces of the primary form. Fracture uneven, conchoidal. Hardness: scratches glass easily. Electricity: according to Hauy the transparent varieties when heated become electric; the termination of the prism which presents the greater number of faces becoming positive, while the other end becomes negative. Colour white, brown, blue, yellow, green, red, and black. The blue variety is called *indicolite*, and the red *rubellite*. Lustre vitreous. Transparent, translucent, opaque. Specific gravity 3·069 to 3·076. Before the blow-pipe all the varieties fuse readily with borax, producing at first slight effervescence.

Tourmalin occurs most commonly in primary rocks, especially in granite, gneiss, and mica slate. Its localities are too numerous to be stated. We may however mention that the red variety, or rubellite, occurs in Siberia; the blue, or indicolite, at Uto; the green in Brazil; the black in Devonshire and many other places. The composition of tourmalin is extremely various; that of the red appears, from the analysis of Vauquelin, to be the simplest, consisting of,—

Silica	42
Alumina	40
Soda	10
Oxide of manganese .	7
	99

Some varieties contain also potash, lithia, lime, magnesia, oxide of iron, and boracic acid; the proportions of these constituents are extremely variable, and no one variety contains all the enumerated substances. The black tourmalin from Devonshire yields nearly 19 per cent. of oxide of iron, and that of Eibenstock nearly 24 per cent. of the same oxide.

TOURN. [Leet, p. 388.]

TOURNAMENT, or TOURNEY, is from the French *Tournoi*, formerly *Tournoiement*, for which the Latin writers of the middle ages use *torneamentum*, *tornamenum*, or *turneimentum*, and sometimes also *torna*, *torne*, *ornatio*, *tornerium*, or *torneta*. The Byzantine annalists have transformed the word into *ternementum* (Τερνεμεντον). Among other etymologies which have been proposed one s, that torneamentum is a corruption of an imaginary word Trojamentum, meaning the game of Troy (called by the Romans Troja or ludus Trojae), which Virgil describes *Æn*. v. 545-602), as performed by the Trojan youth under the direction of Æneas, at the tomb of Anchises in Sicily, and which is also mentioned by Suetonius (*Jul*. 39; *August*. 43; *Claud*. 21); by Dion Cassius, or Xiphilinus xlviii. 20; xlix. 43), and even by Claudian (vi. *Cons. Honorii*, 622, &c.), as still practised in his day, the end of the fourth or beginning of the fifth century. There can be little doubt, however, that tournoiement means merely a turning or wheeling about, from the common French verb 'tourner,' to turn. This will agree with other tourns. We have in England the sheriff's turn or tourn. Other barbarous Latin words of the same connection are *ornare*, to turn about in fight, and also to call out or challenge to combat (in which last sense there is also the old French lui tourner (or torner), par gage de bataille); *torneare*, *torniare*, *turneare* (in French *tournoier*), *torniamentare*, and *torneizare*, to take part in a ournament; *torniator*, a performer in a tournament. Du Cange, *Glossarium ad Scriptores Med. et Inf. Latinit*., vi. 1184-1192; Carpentier, *Glossarium Novum*, ii. 1033; H. Spelman, *Glossarium Archaiologicum*, p. 541; Fr. Junii *Etymologicum Anglicanum*, ad vv. *Tourneying* and *Tournoy*.)

A tournament may be defined to have been a species of combat in which the parties engaged for the purpose of exercising and exhibiting their courage, prowess, and skill in arms, and not either out of enmity (as in ordinary warfare), or even (as in the modern duel) for the mere purpose of wiping off some dishonourable imputation (a purpose which was served rather by the antient ordeal, or wager of battle, than by the tournament). It is obvious, however, that although the primary and professed design of the tournament was nothing more than to furnish an exciting show, and to give valour and military talent an opportunity of acquiring distinction, other passions would be very apt to intermingle in the heat of contest with the mere ambition of superiority, and sometimes even to disguise themselves under that pretext. The attempt to defeat and disarm an adversary, indeed, could hardly fail in some cases to involve the desire of injuring or even of destroying him. In this way a tournament would often become a hostile conflict. On the other hand, whenever, as also frequently happened, a combatant engaged in a tournament with the view of vindicating his courage from question or aspersion, it might be said to resemble the modern duel, at least if we adopt what is perhaps the most rational theory of that process, namely, that, on the principle of courage being the point of honour in a man, it is only intended to give a calumniated party an opportunity of showing that he possesses enough of that essential quality to entitle him to exemption from reproach on any other account.

The origin of the tournament, as we have seen, has been carried back at least to the Roman times. Virgil's description is, in some passages, not unlike what the name would lead us to suppose the tournament may have originally been; but the resemblance of the Game of Troy is certainly better preserved in the evolutions of a modern review, in which the charge, and mêlée, and retreat of cavalry are exhibited, than it was in what the tournament is known to have actually become. The tournament, like the other customs of chivalry, must be properly considered to have taken its rise after the establishment of the feudal system. Some writers attribute the invention of the tournament to the emperor Henry, surnamed the Fowler, who died in 936; and another common account, given on the authority of the Chronicle of Tours, and the Chronicle of St. Martin of Tours, is that its inventor was Geoffrey of Preuilly, ancestor of the counts of Anjou, who died in 1066; but Du Cange, in his Dissertations 'De l'Origine et de l'Usage des Tournois,' at the end of his edition of Joinville, quotes various notices of tournaments held before the age of either of these personages:—among others one which took place at the celebrated interview between Louis of Germany and Charles the Bald of France, at Strassburg in 841, as mentioned by the contemporary chronicler Nithard. Geoffrey of Preuilly perhaps introduced the tournament into Western France. From the French it appears to have passed to the English and the Germans, and, in a later age, to the Italians and the Greeks. Tournaments are said to have been first practised by the English in the time of Stephen; but they were forbidden by Henry II., as they had already been by the church; and it was not till the reign of Richard Cœur-de-Lion that they were properly established in this country. The flourishing æra of the tournament, here as well as in France and elsewhere, was in the thirteenth and fourteenth centuries; but it continued in frequent use down to the middle of the sixteenth, and was not altogether abandoned till a considerably later date, although the few tournaments that were held in the latter part of that century were rather such mere shows or spectacles as have been sometimes exhibited under the same name even in our own day, than the real combats which were so called in an earlier age. The accident of Henry II. of France meeting his death at a tournament in 1559 almost at once occasioned the cessation of the practice everywhere as well as in France; but the spirit by which it was formerly kept up had long before this been decaying under the influence of the various circumstances which, at least from the middle of the preceding century, had been operating a general change in the social condition of Europe. Among the physical causes in question the chief may be considered to have been the introduction of fire-arms into war; among the moral, the extension of the commercial spirit, and the rise everywhere of a new literature, together bringing with them other habits, other tastes, another civilization. The church, however, it may be observed, which had set its face very stoutly against tournaments from about the middle of the twelfth to the middle of the thirteenth century, prohibiting persons from engaging in them by some of its decrees on pain of excommunication, and denying Christian burial to such as lost their lives in these contests, had long been reconciled to them, and for some ages had rather cherished and encouraged the practice than otherwise.

Tournaments were usually held on the invitation of some prince, which was proclaimed by his heralds throughout his own dominions, and at all the foreign courts or other places whence it was expected or desired that parties might come to take part in the martial competition. A detail of the forms and ceremonies that were observed in fixing the lists (or boundaries within which the fighting was to take place), in offering and accepting the challenges, in declaring the issue of each encounter, and in assigning and bestowing the prizes (which last office was often performed by female hands), cannot be attempted here.

All these particulars, together with the usual laws or regulations of the combat, and the mode of fighting (which was commonly with lances and swords, and in the first instance always on horseback, although parties who were dismounted frequently continued the contest on foot), may be most conveniently learned from the many accounts of tournaments in Froissart and other old chroniclers, or even from such fictitious narratives as the 'Knight's Tale of Palamon and Arcite,' in Chaucer (or Dryden's paraphrase of it), or that of the tournament at Ashby, in Scott's 'Ivanhoe.' Scott, in his 'Essay on Chivalry' (*Miscellaneous Prose Works*, vi. 60, &c.), remarks that it is a mistake to assume, as has been done by Cervantes among others, that the combatants at a tournament were always knights; the more distinguished among the esquires, he shows, were frequently admitted to that honour. In another part of this 'Essay' (pp. 44, 45), Scott represents the dangers of the original tournament as having been subsequently 'modified by the introduction of arms of courtesy, as they were termed; lances, namely, without heads, and with round braces of wood at the extremity, called rockets, and swords without points and with blunted edges.' According to Ducange, on the contrary (*Dissertation des Armes à Outrance, des Joustes, de la Table Ronde, des Behourds, et de la Quintaine*, in his edition of Joinville), the arms of courtesy, *armes courtoises* (which he compares with the *lusoria arma* and *lusoria tela* mentioned by Seneca), were the weapons originally used, and were afterwards exchanged for those with sharpened edges and points, which were denominated *armes à outrance*. *Outrer* means properly to pierce an enemy with sword or lance; and at a tournament, when one of the parties was vanquished, either by being killed, or by surrendering and asking quarter, or by being thrown out of the lists, the contest was said to be *outré*—'le gage de bataille étoit outré.'

The distinction between a tournament and a joust, or just, is not very clear. Ducange makes the joust to be properly a single combat or duel, whereas in a tournament a considerable number of combatants were commonly engaged on each side. But this distinction is certainly not generally observed in the use of the two words; and our English archaeologist, Spelman, who defines *torniare*, 'gladiis concutere, *justas facere*, hastitudium exercere,' does not appear to have been aware of it. The term jouste or joust has been derived, improbably enough, from the Latin 'juxta,' near to, because, say the etymologists, the combatants here fought hand to hand. It is, no doubt, connected with the verb to justle, or jostle (in French, *jouster*), though possibly the original word may be best preserved in the Italian form *giostra*, which the Byzantine writers have imitated in their τζουςτρα and τζουστρια. There was also the species of single combat termed a *pas d'armes*, or passage of arms: it was at a *pas d'armes* that Henry II. was killed. On this subject, besides the works quoted above, the reader may consult the 'Traité des Tournois, Joustes, Carrousels, et autres spectacles publics' (par Claude François Menestrier), 4to., Lyon, 1669; and 'Mémoires sur l'ancienne Chevalerie, considérée comme un Etablissement politique et militaire,' par J. B. de la Curne de St. Palaye, 3 tom. 12mo., Paris, 1759-1781.

TOURNAY, or DORNICK, or DOORNIK, an important town in the province of Hainault, in the kingdom of Belgium, 46 miles south-west of Brussels by Hal, Enghien, Ath, and Leuze. This town is mentioned by Jerome in the beginning of the fifth century, under the name of Tornacus, as being among the places which had been seized by the barbarians who overran Gaul. It was among the early acquisitions of the Franks; and was the capital of the as yet infant empire of Clovis. It underwent various changes in the middle ages, and was besieged and taken (A.D. 1513) by the English under Henry VIII., who erected a castle here. Having reverted to the French, it was again taken (A.D. 1521) by the count of Nassau, one of the generals of the emperor Charles V., and ceded by the treaty of Madrid (A.D. 1525) to the emperor. During the religious troubles of the Netherlands, the Protestants committed great disorders here (A.D. 1566); and the town, having joined in the revolt against Spain, was taken (A.D. 1581) by the duke of Parma, and remained under the dominion of Spain. It was taken by Louis XIV. (A.D. 1667) and ceded to France by the peace of Aix-la-Chapelle (A.D. 1668); but having been again taken (A.D. 1709) by the allies under Marlborough and Eugene, it was at the peace of Utrecht (A.D. 1713) ceded with the rest of the Spanish Netherlands to Austria. It was taken (A.D. 1745) by the French under Louis XV., but restored at the peace of Aix-la-Chapelle, A.D. 1748. It was repeatedly taken (A.D. 1792-4) in the early part of the war of the French revolution; and has changed masters with the rest of Belgium several times.

This town is situated on the Schelde, which here flows north-west and divides the town into two parts, the old town on the left bank and the new town on the right: the old town occupies the site of the Tornacus of the antients: the new town is of later origin and is distinguished from the old by the neatness and tolerable straightness of its streets, by its well-built houses, and by its handsome quay planted with trees, which forms the most frequented promenade of the city. The cathedral in the old town is a large and fine Gothic building with several towers (one of our authorities says four, another five) surmounted with spires. The interior of the church is adorned with the richest carving and other ornaments. The tomb of the Frankish king Childéric I. was discovered nearly two centuries ago, in demolishing an old house near the cathedral, seven feet below the surface of the ground: a number of coins and other antiquities were also found. The church of St. Martin, the Episcopal palace, the town-hall, the bell-tower, and the hospital for old clergymen, are among the other principal edifices. The town is fortified, and is entered by seven gates: it has several suburbs.

The population of Tournay is not adequate to the great extent of the town; it amounted in 1835 to 29,000. The manufactures of the town are important, and comprehend cotton-yarn, printed cottons, dimities and other cotton goods, carpets, hosiery, linen, swanskin, paper, hats, leather, earthenware, porcelain, oil, liqueurs, especially Curaçoa, bronze, &c. There are dye-houses and lime-kilns, and (at least) four large flour-mills, built by Vauban: considerable trade is carried on. There are a subordinate court of justice, and a commercial court, a chamber of commerce, an exchange, a theatre, and an Athenæum; an academy of drawing, sculpture, and architecture, in which instruction in outline drawing is given; an orphan-house, some schools of mutual instruction, five hospitals, and several churches. Limestone and sandstone are quarried in the neighbourhood. Tournay is the seat of a bishopric which dates from the latter part of the fifth century; the bishop is a suffragan of the archbishop of Mechelen or Malines. (Malte-Brun, *Géographie; Dictionnaire Géographique Universel.*)

TOURNEFORT, JOSEPH PITTON DE, a celebrated botanist, was born June 5, 1656, of a noble family at Aix in Provence, in the present department of Bouches du Rhône. Having a great taste for observation, the study of nature soon disgusted him with scholastic philosophy and theology, in which he was employed, in order to please his relations, who wished him to enter holy orders. The death of his father, in 1677, enabled him to follow his own inclination; and having exhausted the fields of his own country and the garden of an apothecary, he went to the Alps, in order more fully to satisfy his curiosity. At Montpellier, whither he had gone to study medicine, and where he was received by Magnol, and became the friend of Chirac, he found fresh stores of information; and he collected still richer from the Cévennes, the Pyrenees, and from Catalonia, to which places his zeal carried him. In these excursions he was twice robbed by the Spanish miquelets (or foot soldiers), who left him nothing but his plants; he was buried also for two hours under the ruins of a hut where he was passing the night; and thus he seemed to be inuring himself to the fatigues he was one day to undergo in longer travels. He was already possessed of rich collections and numerous observations, when he repaired to Paris, where Fagon, chief physician to the queen, and curator of the Jardin du Roi, was the sole patron of botanical studies. Fagon knew how to appreciate both knowledge and merit; his character, as well as his rank, placed him above jealousy; and Tournefort found in him a disinterested protector. In 1683 he was appointed assistant professor with Fagon at the Jardin du Roi, whose numerous other occupations allowed him but little time for teaching. The way in which Tournefort fulfilled this office soon made him known, and attracted from all parts a crowd of students to his lectures and herborising excursions. In 1688 he was commissioned to travel through Spain and Portugal, and shortly after through Holland and England, in order to enrich the Jardin du Roi with the plants of these countries. These travels made him acquainted with the most distinguished scientific men of the countries he visited, and gained him their friendship and esteem. Being made, in 1692, a member of the Académie des Sciences, he proved by his 'Elémens de Botanique,' which was published shortly afterwards, how well he deserved that honour. The title of Doctor of Medicine was conferred upon him by the Faculty of Paris in 1698. He again left France in 1700, being sent by the king to the East to collect plants and make observations of all kinds. In company with the German botanist Gundelsheimer, and the celebrated artist Aubriet, he spent two years in travelling through the islands of Greece, the borders of the Black Sea, Georgia and the environs of Mount Caucasus, Asia Minor, and Armenia. He was preparing to go to Egypt, when, hearing that the plague was ravaging that country, and that his patron Fagon was dangerously ill, he hastened back to his own country, to which he was called both by gratitude and friendship. Having resumed his duties at the Jardin du Roi, and being also appointed professor to the Faculty, he spent the little spare time he had in arranging his numerous collections and in drawing up different works, especially the account of his travels in the Levant. The fatigues of work and his travels had much weakened his originally robust constitution, and a violent blow which he received on the breast from the axletree of a carriage tended still more to impair it; so that, after lingering some months, he ended his laborious life the 28th day of November, 1708. By his will he left to the king the valuable zoological museum which he had formed, and his library to the Abbé Bignon.

A judicious and lively mind, and a natural gaiety of disposition, rendered Tournefort equally fitted to succeed in scientific investigations and to form the charm of his friends in society. His attachment to his own country made him refuse the solicitations of Paul Hermann, who wished to have him for his successor, and offered him, in the name of the states of Holland, the situation of professor of botany at Leyden, with a salary of 4000 francs (160*l.*).

The system of Tournefort was an advance on those of Cesalpino, Morison, Hermann, Ray, and Rivinus, but has since been displaced by those of Jussieu, De Candolle, and others. Authors had previously only employed themselves in grouping plants into classes; the much more important determination of the genera was still almost entirely wanting. It is this subdivision of the subject which Tournefort executed with such admirable acuteness, and which distinguishes his labours from all that had preceded him; and it is this, joined to a classification simple, easy, and almost always natural, which caused his method to be afterwards adopted by the botanists of all countries.

Tournefort adopted the principle that genera should be constructed on characters derived from both the fructification and organs of vegetation. In seeking for order he had the good sense not to pretend to an absolute regularity, which nature nowhere presents; and felt (which has been too often forgotten in our day, and which has introduced into natural history so many useless genera, and so many parasitical denominations) that the generic characters must admit of exceptions which are commanded by nature itself. Linnæus, when again reforming the science, adopted the greater part of the genera of Tournefort; but having constructed his genera on characters derived from the fructification alone, he was obliged to reject many of Tournefort's genera. The principle of Linnæus is now generally acted on by modern botanists. The plates which Tournefort has given characteristic of the genera are, even to the present day, for the most part, the best means of understanding them: they are well executed, and upon a plan at that time quite new, and are a proof of his taste, as well as of his spirit of order and observation.

Although he did not think that the consideration of the natural relations of plants (of which the first glimpses were to be met with in the works of Lobel and Magnol) could serve as the basis of an easy classification, still he generally observes the most marked of these relations, and the greater part of his classes form one or more large families. The separation of the woody from the herbaceous plants, which nature frequently offers together in the same genus, and which was admitted by the botanists of Tournefort's time, is in his system a defect which an increased knowledge of the structure and functions of plants has long since caused botanists entirely to abandon in their systems of classification, however much advantage may be derived from it for practical purposes.

Tournefort did not do for the species what he had so well accomplished for the genera; as he left confounded with them simple varieties, even those which are evidently only the result of cultivation. Neither did he think of giving them names more convenient than those which were then in use, and which were commonly vague, and often very long and complicated. These inconveniences Linnæus got rid of; and at the same time he arranged the vegetable kingdom according to his celebrated sexual system, in which plants were placed in classes and orders according to the number of their stamens and pistils. But the system of Tournefort was never abandoned in France, and the study of its principles resulted in the labours of Adanson, Jussieu, and De Candolle, to whom we are so greatly indebted for the present position of systematic botany.

The 'Institutiones Rei Herbariae' is distinguished for its clearness and precision, and for a number of very just observations. The historical part of this work, which is the most considerable, displays much solid learning, which has been of great use to those who have since his time written on the history of botanical science. The different travels of Tournefort enriched botany with a great number of species, and even of genera. He brought back from his travels in the East more than thirteen hundred plants, the greater part of which were in the Herbarium of Gundelsheimer, his companion; and have been since examined by Willdenow, who has mentioned them in his 'Species Plantarum.' If the history of the plants in the environs of Paris, by Tournefort, divided into six herborizations, is of little importance as to the number of species described (which is only four hundred and twenty-seven), still it is a very valuable work in other respects. By the exactness of the synonymes, and by the skill with which the plants are referred to the nomenclature and to the plates of the antient botanists, whose errors Tournefort corrects, this work furnishes an excellent model of criticism. There is also to be found in it a faithful description of some rare plants, which are omitted in his other works. Haller however rather over-estimates its value, when he is inclined to regard it as the chief of Tournefort's writings ('praecipium fortè Tournefortii opus'). One may judge of Tournefort's reputation, and of the value that was put upon whatever he wrote, from the fact of his lectures on Materia Medica having been collected by his pupils, and translated and published in English before they appeared in French, which was not till some years after his death. The account of Tournefort's travels was for a long time the source of our most accurate information about the countries which he visited. The simplicity of the style does not lessen the interest of the narrative. To the observation of nature he joins everywhere that of men, manners, and customs, and shows an extensive knowledge both of history and antiquity.

Among the manuscripts left by Tournefort was a botanical topography of all the places which he had visited, and a large collection of critical and other observations, which has never been published, though it was entrusted to Réneaulme to arrange for that purpose. The genus of American shrubs, to which Plumier, out of honour to his master's memory, gave the name of 'Tournefortia,' derives its chief interest from this celebrated name. [TOURNEFORTIA.]

There are few of the scientific men of France whose reputation has extended more widely than Tournefort's, and who have done more honour to their country. A judicious and methodical mind, an ingenious acuteness joined to extensive views, are his peculiar characteristics. If he had not the profound and original genius of Linnæus, nor such an extensive knowledge of nature, in botany at least Tournefort's name still continues, in spite of the revolutions of science, to be one of the very highest which can be placed by his side; and he has in addition the glory of having opened to him, by the creation of the genera, the extensive field which he afterwards traversed.

The following is a list of Tournefort's principal works:— 'Elémens de Botanique, ou Méthode pour connaître les Plantes,' Paris, 1694, 3 vols. 8vo., with 451 plates. Some imperfections in this work were pointed out by Ray, to whom Tournefòrt replied in a Latin work, entitled 'De Optima Methodo Instituendâ in Re Herbaria ad Sapientem Virum G. Sherardum Epistola, in quâ respondetur Dissertationi D. Raii de variis Plantarum Methodis,' Paris, 1697, 8vo. In 1700 he published a Latin version of his 'Elements of Botany,' with many additions, and a learned preface, containing the history of the science; it was entitled 'Institutiones Rei Herbariae, ed. altera, Gallicâ longè auctior,' Paris, 3 vols. 4to., with 476 plates. After his expedition to the East he published 'Corollarium Institutionum Rei Herbariae, in quo Plantae 1356....in Regionibus Orientalibus observatae, recensentur....et ad sua Genera revocantur,' Paris, 1703, 4to., with 13 plates. This was afterwards added to Ant. de Jussieu's edition of the 'Elements,' in 1719, Lyons, 3 vols. 8vo. 'Histoire des Plantes qui naissent aux Environs de Paris, avec leurs Usages dans la Médecine,' Paris, 1698, 12mo. An improved edition of it was given by Bernard de Jussieu, in 2 vols. 12mo., 1725; and an English translation was published by Martyn, London, 2 vols. 8vo. in 1732. 'Relation d'un Voyage du Lévant, fait par Ordre du Roi, contenant l'Histoire Ancienne et Moderne de plusieurs Iles de l'Archipel, les Plans des Villes et des Lieux les plus considérables, et enrichie de Descriptions et de Figures de Plantes, d'Animaux, et d'Observations singulières touchant l'Histoire Naturelle.' The first volume of this work was printed at the Louvre before his death; the second was completed from his manuscripts; and both were published in 1717, 2 vols. 4to. There have been several French editions, and it has been translated into English, London, 1741, 3 vols. 8vo. 'Traité de la Matière Médicale, ou l'Histoire et l'Usage des Médicamens et leur Analyse Chimique, Ouvrage posthume de M. Tournefort, mis au jour par M. Besnier,' Paris, 1717, 2 vols. 12mo. This work, which was not published in French until after the death of the author, had been already translated and published in English, London, 1708 and 1716, 8vo. (*Biographie Médicale.*)

TOURNEFO'RTIA, a genus of plants of the natural family of Boraginaceæ, so named by Linnæus in honour of Joseph Pitton de Tournefort, celebrated as the author of the 'Institutiones Rei Herbariæ,' which is the chief foundation of the method of arranging plants afterwards extended and formed into a system by Jussieu. He was author also of 'Travels in the Levant,' and of other works. The genus Tournefortia is characterized by having a salver-shaped or rotate corol, of which the throat is naked; the stamens included within the tube of the corol. The stigma is peltate, and the fruit consists of a berry which contains four 1-seeded nuts. The species are about fifty in number, forming small shrubs or herbs, diffused through the hot parts of the world, as the West Indies, South America, Indian islands, and India. The flowers are small and inconspicuous, and the plants, though easy of culture, are seldom worth it; but *T. loxensis*, a native of Quito, at an elevation of 6000 feet, is a shrub which, like the Heliotrope, has a very grateful scent.

TOURNEMINE, LE PE'RE RENE' JOSEPH, Jesuit, occupies a subordinate but useful and honourable position in the literary history of France. He belonged to an antient family in Bretagne, and was born at Rennes on the 26th of April, 1661.

In 1680, at the age of nineteen, he entered the Society of the Jesuits. His superiors thought that his peculiar talents qualified him for a teacher, and his subsequent career showed the correctness of their opinion. For about twenty years he taught in different colleges of the Order, with eminent success, humanity, rhetoric, philosophy, and theology; and while thus instructing others he was accumulating information in the belles-lettres,—physical, moral, and metaphysical science—theology, history, geography, and numismatics—that was to fit him for the employment of nearly twenty years of his matured intellect.

During the period of his life which was spent in discharging the duties of a teacher, he was regarded by his brethren as possessed of an active and penetrating mind, a lively imagination, which sometimes overcame his judgment, and a fervid but not ascetic spirit of devotion. In the colleges he undertook voluntarily the superintendence of the religious studies and exercises of the pupils; and he extended his watchfulness not only to the students in the colleges, but to those in the academies and seminaries in which the young nobility received the rudiments of their education under the direction of the Jesuits.

In 1701 Tournemine was called to Paris to take the management of the 'Journal de Trevoux,' a periodical publication, which, although at times disfigured by the narrow views and unamiable temper of sectarianism, has rendered services to literature that entitle it to a better reputation than the equivocal one in which it is held by the mass of readers who know it only from the sarcasms of Voltaire. Tournemine was the principal editor of this work for nineteen years, from 1701 to 1720. He contributed to the journal during this time a number of curious dissertations and analyses which procured for it a high reputation throughout Europe. Superior to the partisan spirit of many of his brethren, he was sufficiently impartial to combat the systems of Hardouin and Panel; and free from bigotry, although sincerely religious, he praised highly the 'Merope' of Voltaire, and even when engaged in controversy with its great author, always treated him with respect.

In 1720 he was freed from the laborious task of editorship, but still continued to contribute largely to the pages of the 'Journal de Trevoux.' Indeed the variety of studies to which, as teacher and editor of a critical journal, he had found it necessary to turn his attention, appears to have produced in him desultory habits of thought, and prevented the concentration of his powers upon any one topic so as to enable him to exhaust it. The Order, regretting that his time and talents should be thus wasted, appointed him librarian to the residence of professed Jesuits (maison de professe) at Paris, and after the death of Bonami (1725) employed him to continue the literary history of the Society from the period to which it had been brought down by Southwell. Tournemine entered with enthusiasm upon his new task. He called upon all the provinces to supply him with memoirs, and instituted researches in the archives of the Society at Rome. The habits of thought however which he had contracted led him to undertake the work on a scale beyond what it was possible to accomplish, and unfitted him at the same time for persevering routine labour. The over-minute investigation of details, and the episodical inquiries into which he was continually seduced, diverted him from the completion of the work he had undertaken, and he failed to perform his engagements.

Tournemine died at Paris on the 16th of May, 1739, in the seventy-ninth year of his age, regretted by all who knew him. He has left no work worthy of his talents and opportunities, yet he has not been without influence upon literature. As a teacher and journalist, and in the conversation of private society, he prompted and encouraged many young writers. His knowledge was at the service of every one who asked it, and the information which he did not himself elaborate into any enduring work was yet of material service to others. He belonged to a class of minds which, although they leave little or no permanent trace of their individuality, are indispensable to the creation of a national literature—those who go to form a literary public, animating and instructing writers by its sympathy and subordinate co-operation.

A list of Tournemine's writings is given in the forty-second volume of the 'Mémoires de Niceron,' and in the Dictionary of Chaufpié. They consist chiefly of his contributions to the 'Journal de Trevoux.' He contributed the chronological tables to the edition of the Bible published by Duhamel in 1706. He published in 1719 an edition of Menochius's 'Scriptural Commentaries,' to which he appended a system of chronology and twelve dissertations on different points of the chronology of the Bible. In 1726 he published an edition of Prideaux's 'History of the Jews,' and added to it a dissertation on the books of Scripture not recognised as canonical by Protestants, and some remarks upon the ruins of Nineveh and the destruction of the Assyrian empire. Tournemine's 'Réflexions sur l'Athéisme' were printed as an introduction to two editions of Fénélon's 'Traité sur l'Existence de Dieu;' and in reply to Voltaire, who had invited him to clear up his doubts, he published in the 'Journal de Trevoux' (October, 1735) a letter on the immateriality of the soul, which does not appear to have convinced the philosopher. Sketches of the life of Tournemine are contained in the 'Journal de

Trevoux' for September, 1739; and in Belingan's 'Observations sur les Ecrivains Modernes,' vol. xviii. There is also a well-executed memoir of him by M. Weiss in the 'Biographie Universelle.'

TOURNEUR, PIERRE LE, was born at Valognes in 1736; he studied in the college Des Grassins at Coutances, where he distinguished himself; and appears to have repaired to Paris about the year 1767 or 1768, with a view to earn his subsistence by literary labour. His history from that time till his death, in 1788, is little more than an account of his publications and the reception they met with.

He published in 1768 a thin octavo containing a few prize essays which had been crowned by the academies of Montauban and Besançon in the years 1766 and 1767; and an 'Eloge de Charles V., Roi de France,' which had been unsuccessful in the competition of the French Academy in the latter year. This seems to have been his only attempt at original publication, with the exception of a number of prefaces and some verses in two little volumes, entitled 'Jardins Anglais, ou Variétés tant originales que traduites,' which appeared in 1788. His original composition betrays an entirely common-place mind.

In 1769 Le Tourneur published a collection of tales translated from the English, of no importance in itself, and which attracted little or no attention. Towards the close of the same year, or in the beginning of 1770, he brought out a translation of 'Young's Night Thoughts' and miscellaneous poems, which was more successful. He has taken great liberties with the 'Night Thoughts,' omitting several passages, and altering the whole arrangement of the poem, with a view to render it less startling to French taste. Grimm sneered at the work, but Diderot and Laharpe declared themselves warmly in its favour. 'The first edition,' says the former, 'has been exhausted in a few months, and they are preparing a second. It has been read by our petits-maîtres and petits-maîtresses, and it is no slight merit to persuade a gay and frivolous people to read Jeremiads.' He says in the same letter, 'This translation, full of harmony and varied expression, one of the most difficult to execute in any language, is one of the best that has been executed in ours.' The success of the translation of the 'Night Thoughts' appears to have decided Le Tourneur to confine himself in future to that kind of employment.

His first undertaking was a complete and accurate translation of the dramatic works of Shakspere. In this enterprise he was associated at first with the Comte de Catuelan and Fontaine Malherbe, both of whose names are subscribed along with his in the dedication to the king, prefixed to the first volume. But his associates deserted him after the publication of the second volume, and the remaining eighteen were the unaided work of Le Tourneur. The first volume appeared in 1776; the last in 1782. It is difficult for an Englishman to do justice to the merits of a translation of Shakspere into any foreign language. He feels the unavoidable defects too strongly. Thus much however may be said of Le Tourneur's, that it honestly aims at giving Shakspere as he is. The translator has evidently benefited by his knowledge of the German translation by Eschenburg (Zürich, 1775-87), and has prefixed the remarks of that critic to several of the plays. The version is in prose, and by a prosaical mind, yet enough of Shakspere remains to impress minds which know him through no other medium with some sense of his greatness. It is still the best French translation of Shakspere, and as such has been revised and republished by M. Guizot in 1824. Some expressions in the prefatory discourse excited the anger of Voltaire, who thought he saw in it an attempt to decry the merits of the great French dramatists. The controversy to which Voltaire's denunciations gave rise was of advantage to the work by creating a public interest in it. Le Tourneur seems to have taken no part in the discussion: in an advertisement prefixed to the ninth volume he quietly observes, 'This work has triumphed over the absurd hostility declared against it at its first appearance, and the extraordinary wrath of a great poet, the most ardent panegyrist of Shakspere so long as he was unknown, his unaccountable enemy since he has been translated.' Of the original subscribers to the quarto edition a large proportion were English: the sale however increased as the work advanced; a quarto and an octavo edition were published simultaneously: and Le Tourneur, who seems to have become publisher as well as author, adventured on the speculation of publishing in numbers, by subscription, pictorial illustrations of Shakspere.

The translation of Shakspere was far from being the only employment of its author during the time he was engaged upon it. In 1770 he published a translation of Hervey's 'Meditations among the Tombs;' in 1771, a translation of Johnson's 'Life of Savage,' together with an abridgment of the same author's 'Life of Thomson;' in 1777 he published a translation of Macpherson's 'Ossian;' in the same year a translation of Soame Jenyns's 'View of the Evidences of Christianity:' in 1784-7, a translation of 'Clarissa Harlowe;' in 1788, a translation of 'Interesting Memoirs of a Lady;' and his translation of Pennant's 'Description of the Arctic Regions' appeared the year after his death. He also revised the translation of the 'Universal History' begun by Psalmanazar, which some young authors had undertaken at his suggestion.

These are his most important publications. They deserve a place in the history of letters, inasmuch as they contributed to nourish that taste for English literature which was then growing in France, and which has contributed so much to modify not only the taste, but the character of the nation. Diderot, the first to recognise the merits of Le Tourneur as a translator, was the first eminent author of France who really felt the merits of English imaginative writing; his sanction encouraged others to feel, or affect to feel, its beauties. Le Tourneur had the principal share in enabling merely French readers to judge in some measure for themselves. The literary taste of France has not become assimilated to England since the time of Diderot and Le Tourneur, but it has been since their publications entirely revolutionised. Göthe, in his 'Dichtung und Wahrheit,' and in his 'Rameau's Neffe,' has explained the influence which Diderot exercised over the modern literature of Germany, both by his own writings and by directing attention to English authors. It was in part through the medium of French literature that the English literature was made to exercise so strong an influence over that of Germany. The part which Le Tourneur played in this intellectual revolution was an humble but still an important one.

It has been intimated above that Le Tourneur in translating Shakspere was indebted to Eschenburg, and this of itself would imply that he was acquainted with the German as well as with the English language. He published some translations from the former: in 1787 one of Sparmann's 'Journey to the Cape of Good Hope;' in 1788, one of the 'Memoirs of Baron Trenck.' In 1785 he translated and published a selection from the Elegies of Ariosto.

The persevering industry displayed in this brief recapitulation of what was accomplished by Le Tourneur in the space of eighteen years, would lead to the inference that he must have secured an independence by his labours. In addition to this source of income, he held for a number of years the appointment of private secretary to Monsieur, afterwards Louis XVIII.; and for a short time before his death that of censeur-royal. He died on the 24th of January, 1788. An anonymous biography is prefixed to his 'Jardins Anglais;' and M. Weiss has contributed a correct outline of its leading incidents to the *Biographie Universelle*. Le Tourneur had not the slightest pretension to the character of a man of genius, but he was a respectable and useful labourer in the field of letters.

TOURNIQUET is a peculiar kind of bandage applied to a limb for the purpose of arresting the current of blood through its main artery. It is employed for this purpose in several cases, but especially in amputations of parts of the limbs, where large arteries have to be suddenly cut across. Before the invention of the tourniquet surgeons used to constrict the limb with a simple tight bandage; but, although this plan may well be resorted to in an emergency, it not only produces excessive pain, but by obstructing the current through the veins more than that through the arteries, produces an extreme engorgement of the limb, and in amputation permits severe hemorrhage. A slight improvement in this plan was that of twisting pieces of wood under the band, and so gradually tightening it: but the first instrument formed on the principles of the tourniquet was invented by Jean Louis Petit in 1718. Since that time various changes have been introduced, but at present the construction of all tourniquets is nearly similar. They consist of a very tough band, about an inch and a half wide, upon which there is a moveable leather pad, to be placed immediately over the artery on which it is desirable that the chief pressure should be applied. For this purpose also the surface of the pad must be directed towards the bone of the limb, that the artery may be pressed firmly against it. The rest of the band is passed round the limb and is fastened by a buckle. It is tightened and loosened by means of a bridge of brass, which is capable of being elevated or let down by a screw passing through it, and at the ends of which there are two small rollers, around each of which the band is made to take a half turn. In use, the bridge and screw are placed on the opposite side of the limb to the pad.

The tourniquet is now not so generally used as formerly. Many surgeons prefer to have the artery compressed during an amputation by an assistant; because the tourniquet is not free from the objection of compressing the veins as well as the artery, and is liable to accidents which cannot be instantly repaired. An instrument has also been recently invented by Signor Signoroni, a surgeon at Milan, which seems, likely to supersede the tourniquet altogether. It is composed of two arches of steel, connected by a hinge at one end, and each bearing at the other end a pad. By an Archimedes screw ingeniously placed at the hinge, the pads can be approximated and separated like the ends of the blades of a pair of callipers, and can be immoveably fixed in any position. In use one pad is put over the artery, and the other on the opposite part of the limb, and the screw is worked till, in their tendency to approximate, the pads have sufficiently compressed the artery, upon which alone the pressure is thus made to fall.

As already said, in an emergency, such as that of a wound of any of the large arteries of a limb, when medical aid is not near, the old-fashioned tourniquet should be instantly applied. A piece of strong tape or cord should be tied in a double knot round the limb above the wound; a piece of wood, or anything firm, should be then passed under it, and twisted, just as packers tighten the cords round bales and boxes, till the flow of blood has ceased. For hemorrhage from large veins or small arteries this tourniquet should not be employed, but simple pressure with the finger or the hand.

TOURNON, a town in the department of Ardèche in France, on the right bank of the Rhone, 339 miles south-south-east of Paris by Lyon, Vienne, and Tain, which last town is on the left bank of the Rhône, immediately opposite Tournon, with which it communicates by a suspension-bridge of iron bars, the first erected in France on a large scale. The town consists of ordinary houses; the college is the only public building of any pretensions; but there is a handsome quay along the Rhône. On a rock adjacent to the town is an old castle of the dukes of Soubise; and at a little distance north of the town is a handsome bridge of one arch over the Doux, which joins the Rhône just above Tournon. The population in 1831 was 3150 for the town, or 3971 for the whole commune. The townsmen manufacture leather and silk, and trade in the woollen cloths manufactured in the neighbourhood, in wine, timber, and chesnuts. There are one or two government offices, a college or high school, which in the time of Napoleon was in high repute for its excellent management, and an agricultural society. There are eight fairs in the year. The arrondissement of Tournon comprehends 124 communes, and had, in 1831, a population of 129,560.

(Vaysse de Villiers, *Itinéraire Descriptif de la France;* Malte-Brun, *Géographie; Dictionnaire Géographique Universel.*)

TOURNUS. [SAÔNE ET LOIRE.]

TOURRETTE, MARC-ANTOINE-LOUIS CLARET DE LA, naturalist, was born at Lyon in August, 1729, where his father was commandant of the city, Prévôt des Marchands, and Président à la Cour des Monnaies. He commenced his elementary studies at a college of Jesuits in Lyon, and was afterwards sent to the Collége de Harcourt at Paris. He was early admitted a member of the Academy of Sciences at Lyon, and during the last twenty-five years of his life acted as secretary to that body. On returning to his native city he was appointed a Conseiller à la Cour des Monnaies, but he pursued the study of the *belles-lettres* with great assiduity. Dissatisfied however with the tendency of these studies, he engaged in that natural history. He commenced with zoology and mineralogy, and soon formed a large collection of insects and minerals. The establishment of a school of veterinary medicine, by Bourgelat, at Lyon, directed his attention botany. In conjunction with the Abbé Rozier, he was appointed to superintend the formation of a botanical garden, and the giving instruction to the pupils in botany. The result of these exertions was the publication, in 17 of an elementary work on botany, entitled 'Démonstrations élémentaires de Botanique,' 8vo. This work, at first in two volumes, contained a general introduction to knowledge of the structure of plants and their arrangement, with descriptions of the most useful and curious the first edition the introductory matter was entirely done by Tourrette, the description of the plants by Rozier. a second edition nearly the whole was rewritten by Tourrette. This work has since gone through other editions. The fourth consists of four volumes of letter-press in 8vo. and two volumes of engravings in 4to., containing notices of the lives of both Tourrette and Rozier.

In 1770 Tourrette published a voyage to Mount Pilat giving a geographical account of the district, and a list the plants which he discovered there. In 1785 he published the 'Chloris Lugdunensis' (8vo.), in which he described the plants of the neighbourhood of Lyon, and paid especial attention to those belonging to the class Cryptogamia. He published numerous papers on various departments of natural history, in the Transactions of Societies and Journals. Those most worthy of mention were on the origin of Belemnites, on vegetable monstrosities, and the Helminthocorton, or Corsican moss.

He made numerous excursions for the purpose of collecting plants in various parts of France and Italy. some of these herborisings he was accompanied by Jean Jacques Rousseau, with whom he was intimate; and in the published correspondence of that philosopher are seven letters written to Tourrette. He took great pains in introducing foreign trees and shrubs, which he cultivated his father's park near Lyon, and at his own residence the city he had a garden containing 3000 species of plants. He was a correspondent of most of the great botanists his day, as Linnæus, Adanson, Jussieu, and others. During the siege of Lyon he was exposed to fatigue, anxiety, and hardship, which brought on an attack of inflammation the lungs that terminated his existence in 1793.

Tourrette, like most of the botanists who adopted the system of Linnæus, mistook its object, and made it assume a position and importance of which it was utterly unworthy. The consequence was that in his 'Demonstrations' and other works he sought more anxiously to add our knowledge of existing species than to elucidate the structure and functions of the vegetable kingdom.

(*Notice sur la Vie de M. Tourrette*, in the fourth edition of the *Démonstrations Elémentaires de Botanique.*)

TOURS, an important city in France, capital of the department of Indre et Loire, situated on the south bank of the Loire, 124 miles in a direct line S.W. of Paris 140 miles by the road through Versailles, Chartres, Châteaudun, and Vendôme; or 142 miles by the road through Orléans and Blois: in 47° 24′ N. lat. and 0° 40′ E. long.

Tours was known to the Romans by the name of Cæsarodunum; and towards the close of the Roman domination assumed, like many other towns, the name of the people (Turones or Turoni, a Celtic nation) whose capital it was. It was included in the kingdom of the Visigoths, from whom it was taken (A.D. 507) by Clovis, king of the Franks. In the feudal period it came, about the middle of the tenth century, into the hands of Thibaud le Tricheur, count of Blois, one of whose successors in the following century ceded it to Geoffroi Martel, count of Anjou, from whom it passed by inheritance to the Anglo-Norman king Henry II. It was wrested from his son John by Philippe Auguste, and finally ceded to France (A.D. 1259) by Henry III., son of John. Louis XI. had a favourite residence at Plessis-les Tours, in the immediate vicinity of the city, where he died A.D. 1483. The remains of his palace are occupied as a farm-house: the chamber in which he died, and that in which Cardinal La Balue was confined by his order, are still pointed out.

The town stands on a flat tongue of land between the Loire on the north, along the bank of which the town ex nds, and the Cher on the south, which flows a short stance from the town; an arm of the Cher passes into le Loire just below Tours, but the main stream does not in the Loire till several miles lower down. East of the wn is a canal from the Cher to the Loire, and a port for ver craft. Opposite Tours, on the north bank of the oire, is the suburb of St. Symphorien, which is united ith Tours by a modern bridge of fifteen elliptical arches eighty feet span: the whole length of the bridge, which horizontal, and, before the erection of Waterloo Bridge, ondon, was considered the finest in Europe, is about 420 feet; the breadth is between 44 and 45 feet. The venue by which the road from Paris by Chartres pproaches the bridge, the bridge itself, a new street pened through the heart of the city, and lined with handsome houses uniformly built of white freestone and roofed ith slate, and the avenue by which the Bordeaux road eaves the town, are in one line, forming the principal horoughfare, and give to the traveller a high idea of the eauty of the city. The handsome places or squares at ach end of the bridge, and the quays which skirt the ver on the town side, above and below bridge, confirm he impression; but the back streets are narrow, crooked, nd lined with poor houses, and present a striking contrast o the beauty of the principal thoroughfare, which divides he town into two parts. The cathedral of St. Gratien is n the eastern part of the city, and is a fine Gothic building, remarkable for the two towers, more than 260 feet igh, crowned with 'domes,' which adorn the front, and or its well-preserved stained-glass windows. It contains the ombs of Charles VIII. and of his wife Anne of Bretagne. The archbishop's palace, near the cathedral, the office of he prefect, the town-hall, the college, and the museum re handsome buildings; and there are several pubic buildings of less striking appearance, including six other churches. Two towers yet remain of the antient church of the abbey of St. Martin in the western part of he city: Alcuin was abbot of St. Martin's in the last part of he eighth century. In the eastern part, on the quay, is an antient castle, formerly used as a state prison, and now or ately as a barrack. The foundations of this castle are Roman. The town is walled on all sides except towards the iver, and has several suburbs. There are some agreeable promenades and several fountains in the town; and near it re two bridges over the Cher, one of seventeen arches nd one of eight arches.

The population of the commune of Tours was, in 1826, 20,920; in 1831, 23,235; and in 1836, 26,669. The silk manufacture established here by the care of Louis XI., and which long flourished, is still maintained, though Tours is now outstripped as a manufacturing town by others in the south of France: there are some considerable silk-mills, and silk stuffs (known as Gros de Tours) and ribands to a considerable amount are made: silk trimmings and silk stockings are also made; to which articles of manufacture may be added woollen stuffs, carpets, cotton-hose, pottery, earthenware, porcelain, red lead, small shot, wax candles, musical strings, starch, leather, &c. There are some dye-houses, and an establishment for washing wool. Considerable trade is carried on in hemp, wine, dried fruits, wax, and raw silk. There are two important fairs of ten days each. A number of English are settled at Tours: in 1826 they were computed to amount to 1600.

There are several government offices for fiscal, administrative, or judicial purposes. The bishopric dates from the earliest period of the establishment of Christianity in Gaul: St. Gratien was the first bishop; and among his successors were St. Martin, an eminent Father of the fourth century, and St. Gregory, a Father of the sixth century, known as Gregory of Tours, the father of the French historians. It was raised to the rank of an archbishopric in the ninth century. The diocese now comprehends the department of Indre et Loire; and the archbishop has for his suffragans the bishops of Angers, St. Brieuc, Le Mans, Nantes, Quimper, Rennes, and Vannes.

The arrondissement of Tours has an area of 1033 square miles, and comprehends 127 communes: the population in 1831 was 146,570, in 1836 it was 151,119: it is subdivided into 11 cantons or districts, each under a justice of the peace.

Touraine, the country of the antient Turones, constituted one of the military governments of France before the Revolution, and was celebrated for its richness and fertility. It nearly coincides with the present department of Indre et Loire. [INDRE ET LOIRE.]

(Vaysse de Villiers, *Itinéraire Descriptif de la France;* Malte-Brun, *Géographie Universelle; Dictionnaire Géographique Universel.*)

TOUSSAINT LOUVERTURE, one of the most extraordinary men known to have been born of the negro race. It is impossible, amid the highly coloured pictures of him which both the love and hatred of partisanship have produced, to form a fair estimate of his character. We must therefore content ourselves with recapitulating the leading events of his life as correctly as they can be collected from the white-lies of the friends of the negroes, and the somewhat darker-tinged falsehoods of some French republicans.

Toussaint Louverture was born at Breda, a property which then belonged to the Count de Noé, near Cape Town in St. Domingo, in 1743. His father and mother were both African slaves. During the prosperity of Toussaint, a genealogy was compiled, it is insinuated with his privity, which made his father the younger son of an African king. This may be true or not; it is of little consequence.

The first employment of Toussaint-Breda (so called from the place of his birth) was to take care of the cattle on the estate. He received the elements of education from a negro of the name of Pierre-Baptiste. As soon as he could read and write his name, he was promoted by M. Bayon de Libertat, manager of the estate, to be his coachman. He gained the confidence of his master, and was appointed to exercise a kind of superintendence over the other negroes. In this position the Revolution found him. He took no part in the first insurrections, and is said to have expressed himself violently against the perpetrators of the massacres of 1791.

The negroes not unnaturally made attachment to the royal cause the pretext for rising in arms against masters who, with equality and the rights of men in their mouths, still sought to keep them slaves. Toussaint, from 1791 and till the appearance of the proclamation of 4th February, 1794, which declared all slaves free, was alike conspicuous for his zeal in the cause of the Catholic religion and of royalty. He held at first the title of 'Médecin des Armées du Roi,' in the bands of Jean François, but soon exchanged it for a military appointment. Though placed under arrest by the chief just named, and delivered by the other negro leader, Biassou, the ferocity of the latter determined Toussaint to ally himself most closely with Jean François. He became his aide-de-camp. At this time Toussaint was high in the confidence of the Spanish president, Don Joachim Garcia, and apparently entirely guided by his confessor, the curé of Laxabon. When the negroes rejected the first overtures of the French commissioners, Toussaint assigned as his reason, that they had always been governed by a king; could only be governed by a king; and having lost the king of France, had betaken themselves to the protection of the king of Spain.

The proclamation of the 4th of February, 1794, emancipating the slaves, worked a change in his sentiments. He opened a communication with General Laveaux; and receiving the assurance that he would be recognised as a general of brigade, occupied the Spanish posts in his neighbourhood, and repaired to the camp of the French general. His defection was followed by the surrender of Marmalade and other strong places, and threw confusion into the Spanish ranks. An exclamation of Laveaux on learning the consequences of Toussaint's joining his standard ('Comment, mais cet homme fait *ouverture* partout') is said to have been the origin of the name Toussaint subsequently adopted. Laveaux, left by the departure of the commissioners governor of the colony, treated him at first with coldness and distrust; and Toussaint, now past his fiftieth year, reduced to inaction and jealously watched, had reached to all appearance the close of his political career.

In 1795, in consequence of a conspiracy of three of the Mulatto generals, Laveaux was arrested at Cape Town. Toussaint Louverture assembled his negroes; soon found himself, by the support of the partisans of France, at the head of ten thousand men; marched upon the capital, and released the governor. Laveaux, in the enthusiasm of his gratitude, proclaimed his deliverer the protector of the whites and the avenger of the constituted authorities. 'He is,' runs the governor's proclamation, 'the black Spartacus, who, Raynal predicted, would arise to avenge his race.' Toussaint Louverture was created a general of division, and became in fact the supreme arbiter of the fortunes of the colony. When the peace between France and Spain was concluded, Jean François repaired to Madrid, leaving Toussaint the only powerful negro leader in St. Domingo. He reduced the whole of the northern part of the island to the dominion of France, with the exception of the Mole of St. Nicholas, of which the English retained possession. He was the first who succeeded in establishing discipline among the armed negroes.

The arrival of the commissioners sent by the Directory to proclaim the constitution of the year 3, confirmed the credit of Toussaint. In April, 1796, Sonthonax appointed him commander-in-chief of the armies of St. Domingo. In the month of August Toussaint proceeded to the Cape at the head of a large body of cavalry on a visit to Sonthonax. The day after his arrival he proposed, at a meeting of the civil and military chiefs, that the commissioners should be sent back to France. Raymond, a Mulatto, was the only commissioner allowed to remain. The civil administration of the colony was confided to him in the first instance, but he soon resigned the charge into the hands of Toussaint. Fully aware of the boldness of the step he had taken, Toussaint hastened to remove any suspicions that might arise in the minds of the Directory. He sent two of his children to receive their education at Paris; and along with them Vincent, a *chef de brigade*, charged with the task of explaining everything to the Directory's satisfaction. The Directors professed to be perfectly satisfied, and appointed a new commission, at the head of which was placed General Hédouville.

Hédouville on his arrival at St. Domingo showed his suspicions of the negro general by landing within the Spanish territory. Toussaint was at this time engaged in negotiations with General Maitland for the surrender of the strong places held by the English. It was generally known that Hédouville's staff spoke openly in the most hostile and insulting terms of Toussaint; nevertheless he visited the commissioner with scarcely any attendants, and professed the utmost devotion to the French government. Hédouville asserted his right as agent of the republic to reserve the power of ratifying or refusing to ratify any convention between Toussaint and the British commanders. The negro chief nevertheless received the capitulation of Port-au-Prince, St. Marc, Jérémie, and the Mole of St. Nicholas without consulting Hédouville. On the day when the British troops marched out, a public exchange of civilities took place between Toussaint Louverture and General Maitland. All this increased the distrust of the commissioner, who showed it by seeking to thwart the St. Domingo chief in everything. Toussaint Louverture persuaded his countrymen to resume their agricultural occupations. Hédouville soon after issued a proclamation denouncing the *émigrés* and professing to regulate the political relations of whites and negroes. Toussaint immediately issued another proclamation declaring that there were no *émigrés* among the natives of the island; and that the negroes were *de facto* free, but that it was desirable they should continue during five years to labour for their old masters, receiving one-fourth of the produce. His partisans were in the mean time industriously spreading the opinion that Hédouville was an enemy to the negroes and to the tranquillity of the colony. An insurrection broke out at the Cape, which was suppressed by Toussaint; but the commissioner with all his adherents, to the number of twelve or fifteen hundred men, took refuge on board three French frigates which were lying off the island, and sailed for France.

Their departure was the signal for the breaking out of the animosity between the mulattoes and negroes into acts of open violence. Rigaud, the mulatto chief, sanctioned the massacres committed by his partisans; Toussaint did all in his power to repress the ferocity of his. One strong place was taken from the mulattoes by the negroes after another, until Rigaud was shut up in Cayes, the only hold that remained to him. This was towards the close of 1799, and Bonaparte had already assumed the reins of government in France. One of the first steps of the new ruler was to send a deputation to Toussaint, composed of his personal friends Raymond and Vincent, and General Mic They brought the intelligence that Toussaint was confirm in his authority; and Rigaud, seeing himself abando even by his own partisans, embarked with a few of hi tainers to seek an asylum in France.

Toussaint Louverture was now at the summit of prosperity. He assumed much state; and affected to a shade of mystery round the circumstances of his ear career; and took pride in proclaiming himself the n deliverer foretold by Raynal. He preserved great s plicity in his own person, but surrounded himself wi brilliant staff. In January, 1801, he conquered the Sp ish part of St. Domingo. He presented to a central me ing of his partisans a scheme of a colonial constitutio which he was appointed governor for life, authorise name his successor, and to nominate to all offices u government. He exercised this authority to the full tent. He quelled an insurrection of the negroes, and not hesitate to punish with death his own nephew, was at the head of it. Under his strict but just sway agriculture and commerce of St. Domingo flourished.

Bonaparte in the meantime preserved an ominous sile towards all Toussaint's overtures of friendship. The m of the latter, disquieted by the coldness of the First Con was not tranquillized by the proclamation issued immedia after the peace with England, declaring that slavery wa continue in Martinique and Cayenne, and St. Domingo t restored to order. Toussaint met it by a counter-procla tion, issued on the 18th of December, 1801, in which he p fessed obedience to the republic, but at the same time pealed to the soldiers in language which left no doub to his resolution to repel force by force. Bonaparte d patched a squadron of fifty-four sail, under the comma of General Le Clerc, his brother-in-law, to reduce S Domingo.

The first view of this force discouraged Toussaint h self. He soon rallied, but his followers were intimida and divided. The flattery of the First Consul, and the s citations of his own children, were brought to bear on t negro chief in vain. He retired to the Morne of Cha and entombed his treasures where the enemy might s them in vain. On the 17th of February, 1802, he was p claimed an outlaw. The negroes who remained in a were defeated in all parts of the island; Toussaint c tinued nevertheless to defend himself, making a de around him to obstruct the approaches of the enemy. last the defection of Christophe and Dessalines obliged h to listen to terms. The sentence of outlawry pronoun against him was reversed. He was received with milita honours on paying a visit to Le Clerc, and General Brun took his advice on the imposition of taxes, and the se tion of cantonments.

Brunet invited Toussaint to a conference mid-w between Sancey and Gonaives, on the 10th of June; a when the generals retired to hold a consultation, t negro guard was disarmed, and their chief arrested and se on board the Créole, which immediately set sail for Cap Town, where he was transferred to the Heres, a vessel the line. After a voyage of twenty-five days he wa landed at Brest, and without delay sent to Paris. He wa for a short time lodged in the Temple, but soon after co veyed to the castle of Joux, near Besançon, where he wa subjected to a close and severe confinement. His faithfu attendant Mars Plaisir was removed from him. After te months of rigorous imprisonment, he died on the 27th April, 1803.

Toussaint, like all eminent and successful politicians was marked by a strong inclination and power of con cealing his sentiments and intentions. There was a goo deal of imagination or romance in his composition. He ha strong devotional feelings, and a nice sense of domest morality. His reserved and energetic nature commande the respect of the negroes, enabled him to restrain the from excesses and keep them to steady labour, and he thus restored confidence to the whites. He loved splendour in his attendants, but was plain in his personal habits. St. Domingo was peaceable and prosperous under his government. These facts are proved by the concurring testimony of friends and enemies; and they entitle him to be classe among great men. More it would be imprudent to sa positively, considering how conflicting are the witnesse respecting him, and how biassed by passion their evidence Of the selfish meanness of Bonaparte's conduct toward im there can be scarcely two opinions, and the vexatious nprisonment at St. Helena wears all the appearance of ne of those mysterious exercises of the *lex talionis* by rovidence, which sometimes occur in real life.

After the death of Toussaint Louverture, his family ere confined at Brienne-en-Agen, where one of his sons ied. The survivors were set at liberty after the restoraon of the Bourbons. The widow died in 1816, in the rms of her sons Placide and Isaac. M. du Broias has ublished a sketch of the life of Toussaint Louverture.

TOWCESTER. [NORTHAMPTONSHIRE.]

TOWER OF LONDON. That large assemblage of uildings, presenting so many varieties of aspect, age, and urpose, which we call generally by the name Tower, ocupies an elevated area of twelve or thirteen acres, just eyond the old walls of the city of London eastwards, on e northern bank of the Thames. The outline of the uildings, as of the area on which they stand, is an irreular square, gradually narrowing towards the city side. ooked at from without, the Tower plan presents first a road and deep moat encircling a lofty battlemented wall, ith strong towers at intervals through its entire course; en a similar line of wall and towers at some little istance within; among which are interspersed a considerble number of modern buildings for the accommodation f the garrison and other inhabitants of the Tower; and, stly, a great central space, where stands the White ower, the lofty keep of the older fortress, with the Horse Armoury at its base; whilst around the sides of the rea, against the inner walls, are, in different parts, the anient chapel, the remains of the grand storehouse or Armoury, the Jewel-office, and the buildings of the Board f Ordnance. The chief entrance is by the spur, a small nclosure at the south-west corner, originally forming a ind of barbican; between this spot and the central space f the interior the road passes over the moat by a drawbridge, and is defended by three strong towers, the first placed to secure the passage of the moat, the second the ntrance into the ballium or outer ward, and the third, the Bloody Tower, to secure the entrance into the inner ward, r the central space before mentioned. Opposite the exterior front of the Bloody Tower—so called, it is supposed, rom the suicide or murder within its walls of the eighth uke of Northumberland, sent here by Elizabeth for his reasonable correspondence with the unfortunate Mary—is he Traitor's Gateway, which, during the long period of he history of the Tower as a state-prison, formed the eneral entrance for the prisoners. When Elizabeth was brought here, it will be remembered she at first refused to and; but seeing force would be used if she did not, she ried out in the bitterness of her indignation, 'Here landeth as true a subject, being a prisoner, as ever landed at these stairs; and before thee, O God, I speak it, having none other friend than thee.'

The more interesting of the separate buildings of the Tower may be classed as follows:—1, the White Tower; 2, the towers and other buildings or places which have been used for the confinement, execution, or burial of prisoners, and which are still full of interesting personal memorials; 3, the buildings forming or connected with the arsenal, as the Grand Storehouse, Horse Armoury, &c.; 4, he miscellaneous portions of the Tower not previously included. The White Tower, as a building devoted to all the uses mentioned, and as the most antient and interesting part of the fortress, we may with propriety notice first and alone. This is a large quadrangular structure, measuring on its north and south sides 96 feet, and on its east and west 116, and rising to the height of 92 feet. Turret towers rise at each of the four corners; that at the north-east, which is considerably larger than the others, was used by Flamsteed as an observatory before the erection of a building for such purposes at Greenwich. In the interior, the chief apartments on the ground floor are the Volunteer Armoury, where immense quantities of small-arms are kept in convenient and beautiful order, and the room where Raleigh was so long a prisoner; on the floor above, two other armouries, chiefly for the cavalry and naval service; and on the top, the Council-Chamber; whilst the chapel in its height occupies both these upper stories. The Council-Chamber is a very long, broad, and high apartment, with a dark-looking timber roof, formed in a great measure with beams of the largest size, and supported by a double range of wooden pillars or posts. The walls are pierced on the one side with windows, on the other with arches, both undecorated. This rude primeval-looking place formed the council-chamber of our early kings; and here did Richard II. resign his crown to Bolingbroke in September, 1399, saying, in the words of Froissart, 'I have been king of England, duke of Aquitaine, and lord of Ireland about twenty-one years, which seignory, royalty, sceptre, crown, and heritage I clearly resign here to my cousin Henry of Lancaster; and I desire him here in this open presence in entering of the same possession to take this sceptre;' and so 'he delivered it to the duke, who took it.' The Chapel is one of the most perfect specimens we possess of Norman architecture in its most unadorned, but, for the size, grandest shape. The chief features are a double range of massive and lofty pillars with intervening arches, meeting and forming a semicircle at one end, with an upper story of similar arches divided by plain flat piers. A gallery encircles the latter, and an aisle the former; through both of which (but on one side, and at the rounded end only) light passes from the exterior windows of the Tower. The view of the chapel is now sadly obscured by the presses, in which are kept a portion of the Tower records. These comprise crown grants from the reign of the Confessor to the beginning of the thirteenth century; a series of the Rolls of Chancery from the 1st year of John to the last of Edward IV.; the Almain rolls from the 22nd of Edward I. to 15th of Edward III., referring to continental negotiations, treaties, &c.; charter rolls from 1st of John to last of Edward IV.; a most valuable series of the Close rolls, full of various and important historical, political, and social memoranda; with a variety of others, such as the coronation rolls, rolls of parliament (from 5th of Edward II. to last of Edward IV.), patent rolls, Scotch rolls, Welsh rolls, &c. &c. The Record-Office is held in the Wakefield tower. At the foot of the staircase leading into the chapel were found the bones whch were supposed to have belonged to the young princes murdered here by Richard III., and which in consequence were interred in Westminster Abbey by Charles II.

The chief memorials of the state prisoners occur in the Beauchamp tower, so called, it is supposed, from the confinement in it of Thomas de Beauchamp, earl of Warwick, in 1397. By a circular staircase we ascend to the first story, a place now used as the officers' mess-room. The walls are full of inscriptions, many of them of the most touching character. 'Since fortune hath chosen that my hope should go to the wind to complain, I wish the time were destroyed: my planet being ever sad and unpropitious;' is the mournful lament of William Tyrrel, 1541.* 'Geffrye Poole, 1562,' records the infamy of the brother of the famous cardinal, who was enabled to live to write this inscription, by giving evidence against his own aged mother, the marchioness of Salisbury, and who in consequence suffered death in the adjoining area, under peculiar circumstances, the executioner killing her as he followed her round the scaffold. Among many others the memorials of the friends and husband of Lady Jane Grey, of Thomas Miagh, where the writer speaks of 'torture strange,' and of Edmund and A. Poole, the last descendants of George, duke of Clarence, may be mentioned as highly interesting; but above all, let every visitor to the Beauchamp tower look for and ponder over the golden sentence inscribed here by C. Bailly, the agent of the bishop of Ross, in the correspondence between the latter and Mary Queen of Scots, respecting a foreign alliance against Elizabeth:—'The most unhappy man is he that is not patient in adversities: for men are not killed with the adversities they have, but with the impatience which they suffer.' Bailly was at that time aged twenty-nine. The governor's house, formerly the lieutenant's lodgings, in the south-west corner of the central area, is chiefly noticeable for its connection with the Gunpowder conspirators, who were examined in a chamber called the council-room. A marble memorial, erected against the wall, records the particulars of the attempt. In an adjoining room is an inscription cut by the countess of Lenox, 'committed prisoner to this lodging' in 1565, 'for the marriage of her son, my lord Henry Darnley, and the queen of Scotland.' The Bell tower owes its chief interest to the imprisonment of Bishop Fisher within its walls, when committed, with his illustrious friend and fellow-sufferer More, by Henry VIII. It is said that here also Elizabeth was confined. In the Bowyer tower (where the fire broke out in 1841), Clarence, Edward IV.'s brother, was, according to tradition, drowned in a butt of malmsey. Most of the other towers have interesting recollections attached to them, but we can only refer to one, the Flint tower (a modern structure erected in the place of an antient one), for the purpose of observing that the ruins of the last were long known as 'the little hell,' possibly from its containing the Little-ease, where the prisoners could neither stand, sit, nor lie without bending. The locality of the Rats' dungeon, into which innumerable vermin were driven with every flow of the tide, appears to be unknown.

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* The original is in old Italian.

The chapel of St. Peter's, at the north-west angle, is the only one now used for Divine service. This was built in the reign of Edward the First, and, like the other chief buildings of the fortress, is rich in its associations. Here lie Anne Boleyn, with her brother Lord Rochford, Bishop Fisher, the great chancellor More, the venerable countess of Salisbury before mentioned, the minister Cromwell, the two Seymours (the protector and the admiral), Lady Jane Grey, with her uncle and husband, the duke of Norfolk beheaded by Elizabeth for his pretensions to the hand of Mary, Elizabeth's favourite Leicester, the duke of Monmouth, and the Scotch lords beheaded for the rebellion of 1745. The spot on which the scaffold was erected for many of these executions is immediately in front of the chapel; no one can for a moment mistake the outline which the darker appearance of a portion of the pavement of the area presents. Another and the chief place of execution was outside the walls on the neighbouring Tower Hill.

The largest of the buildings connected with the Arsenal exists no longer but as a ruined shell; scattered about the floor of which are the few pieces of ordnance that alone escaped destruction of all its extensive and valuable stores. The building was modern, and in that point of view its loss becomes a mere matter of money; the same may be said of the greater part of its contents. These consisted of a collection of pieces of ordnance on the ground-floor, of all shapes, sizes, and periods; memorials chiefly of our naval and military successes, some of the most valuable of which are preserved; and secondly, of the Small-Arms Armoury on the floor above, fitted up in the most convenient and picturesque manner for the reception of a stand of 150,000 arms. The fire by which the building was so completely destroyed broke out on the night of the 30th of October, 1841; in its course great apprehensions were felt for the safety of the entire fortress, but ultimately it was extinguished without further injury. A novel kind of sale followed the fire (and indeed still continues), of the débris of the conflagration, generally weapons, fused into a variety of peculiar forms and appearances. The other storehouses of the Arsenal are the rooms already mentioned in the White tower and the large modern building parallel with the southern side of the latter; in addition to which there is a Map-office on the eastern side. Under the care of the Board of Ordnance, forming as it were the appropriate historical museum of their department, are the places of exhibition known as the Horse Armoury and Queen Elizabeth's Armoury. The former is a low building resting against the base of the White tower, exactly opposite the Ordnance-office, and from it a staircase leads upwards into the Tower, where we find the prison of Raleigh changed into the smaller armoury that now bears the name of his royal mistress. The Horse Armoury is principally occupied by a row of mounted figures, intended for the display of complete suits of armour, which are here found, from the plain ringed net-work of the days of the Crusaders, through all the growth and decline of the more splendid plate-armour, down to the merely helmeted and cuirassed warriors of the reign of James the Second. Among the suits which demand especial notice is that worn by Henry VIII. (a present from the emperor Maximilian I.), which is most picturesquely elegant in its outlines, and sumptuously decorated in its details. The entire mass of armour for both man and horse is washed with silver, and engraved with legends, devices, mottoes, arms, &c. of the finest workmanship. Among the other suits dispersed about the armoury are two that attract much attention for their diminutiveness: one of them, a complete suit of steel plate, was worn by Charles II. when only in his fifth year. Queen Elizabeth's Armoury was formerly supposed to be in the main a collection of the spoils of the Armada, and the various instruments of torture here shown were looked on so many monstrous inventions of the Spaniards. These now known in most cases to be as genuine English as w the limbs they were intended to torture. Whatever tr there may be in the opinion as to the formation of t collection from the Armada spoils, it is certain that great variety of weapons of which it consists are mostl the fifteenth and sixteenth centuries. They comprise rap bucklers, glaives, catchpoles, blackbills, stilettoes, gisarm voullges, Lochaber axes, Scotch targets, with several k of shot, instruments of torture (bilboes, collar of tort thumb-screw, &c.), and numerous curiosities, among wh is the axe that severed the fair neck of Anne Boleyn.

Since the fire the Regalia [REGALIA] have been exhibited in the new and handsome building recently erect for the purpose in the corner by the old Jewel-offi The mode of exhibition has been strikingly improv The Regalia are enclosed within a glass screen in the ce of the building, over which is a strong open frame-w that, without in the slightest degree interfering with view, renders any possibility of the repetition of suc attempt as that of Colonel Blood almost impossible the same time the spectators can walk round and exa the objects thoroughly. We hardly need add that the li have been removed from the Tower for some years. T Mint also is no longer here, but on the neighbouring h

Of the history of the Tower it can be only possible us to give a very slight notice. Half the history of E land might very well be introduced into a complete hist of the building which has for so many centuries been palace, prison, and arsenal of our kings. Tradit attributes the building to Julius Cæsar; but to speak in less questionable authority, Stow says, 'I find in a register-book of the acts of the bishop of Rochester, down by Edmund of Hadenham, that William I., named the Conqueror, builded the Tower of London wit, the great white and square tower there, about year of Christ 1078, appointing Gundulph, then bishop Rochester, to be principal surveyor and overseer of work, who was for that time lodged in the house Edmere, a burgess of London.' This then was the origi building, which has grown, by successive additions, the Tower of the present day. Of the exact purpose which it was applied we learn nothing earlier than reign of Henry I., when it was used as a state pris Ralph Flambard, the warlike bishop of Durham, was confined in it, and escaped. Stephen held his court he in 1140, so that by that time, at least, the Tower h become both the palace and the prison of royalty. So of the most interesting historical events that have ta place in the Tower have been already incidentally refer to; as to the remainder our space will allow us only mention the most important, and these in the brief manner. From the Tower and the chief palace t coronation processions formerly set out. These appear have commenced with the coronation of Richard II., a to have terminated with that of Charles II. The oth memories of the palace are of a very different natu Richard II.'s deposition, Henry VI.'s supposed murd the similar fate of the young princes, Anne Boley execution,—these are but a few of the incidents whi are recorded in connection with this regal home. B even these recollections sink into insignificance bes the long and bloody roll which records the names of th prison inhabitants. Among those who pined away captivity, or were relieved by the scaffold, to wh the prison doors so often led, we find Hubert de Burgh the Scottish king Baliol; Wallace, dragged hence on hurdle to Smithfield; another Scottish king, David Bruce the far-famed citizens of Calais; Sir Simon Burley, execut on Tower-hill; the poet Chaucer (through his connectio with John of Gaunt and support of Wickliffe); the kin of Scotland (the royal poet James I.); the intrepid quee of Henry VI.; 'poor Edward Bohun,' executed; Si Thomas Wyatt, the same; Raleigh, the same; Eliot, Marten Monk; Strafford and Laud, both executed, as were Sydney and Russell, &c. &c.; whilst in many cases hundreds of their less distinguished friends, associates, and followers shared their captivity or death.

The government of the Tower is vested in the Constable an officer of the highest rank. Langton, archbishop of Canterbury; Hubert de Burgh (prisoner at one time, constable at another); Hugh le Bigod; Sir Hugh Despenser killed with Montfort at Evesham; Tiftoft, earl of Worcester, Caxton's accomplished patron; Fairfax, the parliamentary general; lord Cornwallis—have been among the chief officers of the Tower. The Constable at present (1842) is the Duke of Wellington.

TOWERS, JOSEPH, LL.D., was born in Southwark, the 13th of March, 1737. His education was much neglected, but being fond of reading, he picked up a good deal of knowledge in a miscellaneous way. He was apprenticed to a printer at Sherborne in Dorsetshire, and returned to London in 1764, where at first he got his living as a journeyman printer, and afterwards set up a bookseller's shop in Fore Street. During this time he was also actively engaged in writing for the press, and, in addition to other publications, wrote the first seven volumes of 'British Biography,' of which the first was published in 1766. As his business did not answer,—a thing not surprising, considering his literary engagements, —he relinquished it in 1774, and became the minister of a Dissenting chapel at Highgate. His theological opinions were Arian, though he was closely connected with the Unitarian body. In 1778 he was chosen forenoon preacher at a chapel in Newington Green. About this time he was engaged by the proprietors of the 'Biographia Britannica' to write several lives for the new edition of the work edited by Dr. Kippis, of which however only five volumes appeared (1777-1783, down to the letter F). Towers received the degree of LL.D. from the University of Edinburgh in 1779. He died on the 20th of May, 1799, in his sixty-third year. His pamphlets and smaller works were collected and published in 1796, in 3 vols. 8vo. They are of a miscellaneous nature, but most of them on political subjects.

(Lindsay's *Funeral Sermon.*)

TOWN, in its popular sense, is a large assemblage of adjoining or nearly adjoining houses, to which a market is usually incident. Formerly a wall seems to have been considered necessary to constitute a town; and the derivation of the word, in its Anglo-Saxon form 'tun,' is usually referred to the verb 'tinan,' to shut or enclose; in its Dutch form 'tuyn,' it signifies a garden; and in its German form 'zaun,' it means a hedge. In legal language 'town' corresponds with the Norman 'vill,' by which latter term it is frequently spoken of in order to distinguish it from the word town in its popular sense. A vill or town is a subdivision of a county, as a parish is part or subdivision of a diocese; the vill, the civil district, being usually co-extensive with the parish, the ecclesiastical district, and, *primâ facie*, every parish is a vill, and every vill a parish. Many towns however, not only in the popular, but in the legal sense of the term, contain several parishes, and many parishes, particularly in the north of England, where (probably from the difficulty of obtaining a resident clergy in places exposed to hostile inroads) the parishes are exceedingly large, contain several vills, which vills are usually called tithings or townships. As until the contrary is shown the law presumes towns (or vills) and parishes to be co-extensive, Lord Coke goes so far as to say that it cannot be in law a vill unless it hath, or in times past hath had, a church, and celebration of divine service, sacraments, and burials. But this, for which no authority is given, appears to confound parish and vill, and to be inconsistent with the cases in which it has been held that a parish may consist of several vills. (1 Lord Raymond, 22.) The test proposed by Lord Holt is, that a vill must have a constable, and that otherwise the place is only a hamlet, an assemblage of houses having no specific legal character. Hence a vill is sometimes called a *constablewick*. Towns are divided into cities, boroughs, and upland towns, or (as we should now call them) country towns. Towns belonging to the last of these classes have been described as places which, though enclosed, are not governed, as cities and boroughs are, by their own elected officers. The Anglo-Saxon 'tun' terminates the names of an immense number of places in England; and in the southern counties the farm *enclosure* in which the homestead stands is usually called the barton (barn-*town*), in Law Latin, bertona.

TOWNLEY MARBLES, the name of an assemblage of Greek and Roman sculpture which now forms a portion of the extensive Gallery of Antiquities in the British Museum. It received its appellation from Charles Townley, Esq., of Townley in Lancashire, who began forming this collection at Rome as early as 1768.

About 1772 he brought such acquisitions as he then possessed to London, and placed them in a house in Park Street, Westminster, where by gradual accessions his collection was advanced to its highest celebrity.

It was not to marbles alone that Mr. Townley directed his attention. He had also a collection of terracottas; and he laid out large sums in the purchase of antient bronze figures and utensils, Greek and Roman coins, gems, antique pastes, and drawings, the greater part of which served essentially to illustrate his sculptures. During two or three of the latter years of Mr. Townley's life, feeling his health to be rapidly declining, he employed himself in preparing designs for a Statue Gallery and Library to be added to the mansion at Townley; and enjoined his executors in his last will, dated November 9th, 1802, to complete his plans within five years, otherwise he directed his Marbles to be given to the British public, and to be preserved in their Museum.

Mr. Townley died January 3rd, 1805. After his decease, his executors, upon a mature consideration of all the circumstances of his fortune and collection, came to the decision of offering the marbles and terracottas only to the nation, and of immediately fulfilling Mr. Townley's conditional view with respect to the British Museum. An Act was consequently passed for purchasing them, and the sum voted was 20,000*l.* An additional edifice was built at the Museum for their accommodation, and the collection was opened to public view in 1808.

Mr. Townley's remaining collection of antiquities, illustrative of his Marbles, was purchased and deposited in the same institution under another Act, in 1814, for the sum of 8200*l.*

The Marbles and Terracottas of the Townley collection at present (1842) occupy rooms I., II., III., IV., VI., XI., and XII. of the Museum Gallery. The collection of sepulchral urns, which formerly filled the Columbarium in Room VII., are at present removed to the south recess of the ante-room to the Phigaleian saloon.

The *Terracottas* in Room I. consist of eight statues, sixty-seven bas-reliefs, and nine amphoræ. Some of these were collected in Italy by Mr. Townley himself, others he purchased after his return of Nollekens the sculptor, who had acquired them in Rome at an earlier day. The statues, with one exception, were found about 1765, in a dry well near the Porta Latina. The collection of terracotta bas-reliefs is believed to be the most valuable in Europe. As far as terracotta statues are concerned, the Townley collection is excelled by the museum at Naples. The numbers 7, 8, 16, 24, 26, 47, 56, 59, and 60, among the bas-reliefs, are the most deserving of attention.

Of the Marbles of the Townley collection, about two hundred and fifty in number, we shall point out the most important, as they stand in the several rooms.

Room II., No. 4. A Caryatid larger than life, found in the ruins of the Villa Strozzi, deserves the first notice. It was formerly in the Montalto collection, and is supposed to have formed one of the supports of a small temple, and to have been the work of two Athenian artists of the names of Criton and Nicolaus.

No. 8, in the same room, a statue of Venus, or Dione, is of the highest order. When Canova visited England in 1814, he spoke of it as the finest female statue he had seen in England. It consists of two pieces of marble imperceptibly joined at the lower part of the body, within the drapery; and was found in the ruins of the maritime baths of the emperor Claudius, at Ostia, in 1776.

Two vases of exquisite workmanship stand one on each side of the statue of Venus. One, No. 7, more than three feet high, represents the celebration of the orgies of Bacchus. It was found in detached pieces at Monte Cagnuolo, the site of the villa of Antoninus Pius, at the antient Lanuvium. The other vase, No. 9, of smaller size, presents a Bacchanalian group of four figures only, on the front; but there is no record of the place where this was discovered.

Two busts of Hercules—one of hard character and of an early period of art, found at the Pantanella in Hadrian's villa; the other of the Farnese Hercules, of fine sculpture, dug up at the foot of Mount Vesuvius—also decorate this room, with two colossal heads of Minerva, Nos. 1 and 16; one with hollow sockets to the eyes, supposed to be of a date from 550 to 600 years before the Christian æra: it was found in the neighbourhood of Rome. The bust of the

Farnese Hercules however does not belong to the Townley collection.

Room III. of the Townley Gallery contains an assemblage of statues of a smaller size, busts, terminal heads, and bas-reliefs; these last for the most part are let into the walls.

The Statues consist of a figure of the goddess Fortune, No. 18, her right hand resting on the rudder of a vessel; found at a short distance from Rome, on the Via Latina: a Venus, No. 22; found in a bath at Ostia, in 1775: a Faun, from the Macaroni palace, No. 24: one of Diana's nymphs resting after the chase; found, in 1766, in the Villa Verospi, No. 28: a statue of a youth, No. 31, formerly part of a group of two Boys quarrelling for tali, or huckle-bones: two statues of Fauns, found, in 1775, near Cività Lavinia, Nos. 33 and 43: and Actæon attacked by his dogs, No. 45; found, in 1774, in the ruins of the villa of Antoninus Pius, near Cività Lavinia.

Among the Busts, a head of Hippocrates, No. 20; found near Albano: three terminal heads of the bearded Bacchus; one, No. 19, of very early Greek work, found at Hadrian's villa: a head of Homer, found in some ruins at Baiæ in 1790: a head of Pericles, No. 32: and a terminal head of Periander, No. 42, are the most remarkable.

Of the Bas-reliefs, No. 5, representing warriors consulting the oracle of Apollo: No. 6, Castor managing a horse, in an early style of Greek sculpture: No. 7, Hercules securing the Minalæan stag, in a very early style: and No. 12, a Bacchanalian group, are most important.

The Townley Marbles in Room IV. consist of a bust of Trajan, No. 1; found in an excavation in the Campagna di Roma in 1776: a head of Apollo, of early Greek work, No. 3: a head, supposed to be that of Arminius, No. 4: a statue of Thalia, No. 5; found at Ostia: colossal busts of Marcus Aurelius and Lucius Verus, Nos. 6 and 7: a group of Bacchus and Ampelus, No. 8, found near La Storta: a head of the young Hercules, No. 9; formerly in the Barberini palace: a head, supposed of Dione, No. 10: a statue of Diana, found near La Storta in 1772, No. 11: and a bust of Hadrian, No. 12, formerly in the Villa Montalto.

In Room VI. the more exquisite Statues are, a small torso of a Venus, No. 20: another small one of Cupid bending his bow, No. 22; found, in 1775, at Castello di Guido, on the road from Rome to Cività Vecchia, within a large amphora filled with earth: two figures of Victory sacrificing bulls, Nos. 26 and 31; both found in the ruins of the villa of Antoninus Pius: a statue of Libera, No. 40: another of Ceres, No. 43: a small statue of Jupiter sitting, No. 48: another of a Musa, the plinth inscribed ΕΥΜΟΥΣΙΑ, No. 60: and a small statue of Hercules sitting on a rock, the apples of the Hesperides in his right hand.

The Heads and Busts in this room of highest interest are, No. 15, a head of Jupiter; No. 18, Apollo Musagetes; No. 27, a bust of Hadrian with the imperial paludamentum; a bust of Severus, No. 29, found in 1776 on the Palatine hill; Nos. 32 and 35, heads of the two Faustinas; No. 39, a head of Plautilla; No. 41, of Atys, found in the Villa Palombara; No. 44, a head of Nero, brought from Athens, in 1740, by Dr. Askew; No. 47, a head of one of the Homeric heroes, from the Pantanella at Hadrian's villa; No. 51, a bust of Caracalla; No. 53, a bust of the young Marcellus; and No. 65, a head of Domitia, formerly called Messalina, found in the Villa Casali.

The more curious of the Bas-reliefs are, No. 2, part of the front of a sarcophagus, representing Achilles among the daughters of Lycomedes; No. 4, part of the front of a large sarcophagus, representing a marriage; No. 5, the front of another, representing the nine Muses from the Villa Montalto; No. 7, part of a sarcophagus, representing a funeral car; No. 11, the fragment of a sarcophagus, representing a poet and his muse; No. 23, a funeral monument inscribed ΞΑΝΘΙΠΠΟΣ; No. 28, a beautiful bas-relief of a Bacchante; and No. 54, a bas-relief representing Priam supplicating for the body of Hector.

This room likewise contains a swan in red marble, No. 21; an eagle in marble, No. 34; several altars, cippi, &c.

The Townley Marbles of Room XI. deserving most notice are, No. 16, a statue of an intoxicated Faun: No. 19, a Discobolus, supposed to be an antient copy in marble from the celebrated bronze statue executed by Myro; found, in 1791, in the ruins of Hadrian's villa: No. 21, a statue of Mercury sleeping on a rock: a statue of Bacchus, from the ruins of the villa of Antoninus Pius, No. 22: and a small Mithraic group, No. 45. Beside these, this room contains two statues in bronze: one of Hercules, No. 21, carrying away the apples from the garden of the Hesperides; the other of Apollo, purchased by Mr. Townley at Paris in 1774.

The bas-reliefs and fragments of sepulchral monuments in this room are numerous, but of less important character generally than in the preceding rooms. There are numerous articles also in this room, which originally formed no part of the Townley collection.

Room XII. contains the following Townley Marbles of a superior character:—No. 1, a Head of Juno; No. 2, Cupid in his character of Somnus, sleeping upon the skin of a lion; this sculpture was found in a vineyard near the Flaminian gate of Rome, and once belonged to Cardinal Alessandro Albani: No. 9, a Head of Adonis covered with the pyramidal hood: No. 11, a small bust of Antoninus Pius: No. 12, a singularly beautiful bust of an unknown female, commonly called Isis. It is gracefully terminated by the flower of the Nymphæa lotus, on which it appears to rest. It was purchased at Naples from the Lorenzano family in 1772, and was considered by Mr. Townley to be the gem of his collection. No 13, a Head of one of the Dioscuri: No. 11, a colossal head of Antinous in the character of Bacchus: and No. 20, a bust of Minerva, found in 1784, in the Villa Casali; the helmet and bust of bronze are modern additions to it.

The sepulchral urns in the south recess of the ante-room approaching the Phigaleian Saloon, belonging to the Townley collection, are the Numbers 4, 6, 7, 8, 10, 11, 12, 13, 14, 15, 17, 19, 21, 25. 26, 27, 28, 30, 30*, 31, 33, 35, 36, 37, 37*, 38, 40, 41, and 42.

Since the opening of the Townley Gallery in the spring of 1808, the trustees of the British Museum have added numerous marbles of high character to this part of their collection, and a few have been added by benefactors. The more prominent additions have been, a terminal Head of Mercury, purchased in 1812, at the sale of antiquities belonging to William Chinnery, Esq., Room III., No. 21: a Bas-relief of the Apotheosis of Homer, found at Frattochi, about ten miles from Rome, No. 23, purchased in 1819 at the expense of 1000*l.*; In Room IV. a statue of Apollo, of very early Greek work, purchased in 1818 for 500*l.* at the sale of the Comte de Choiseul-Gouffier's antiquities; Room XI., No. 14, a Mithraic group of large size brought from Rome in 1815, purchased for 300*l.*; No. 18, a statue of a Faun, formerly in the Rondinini palace at Rome, purchased for 350*l.*; No. 23, a statue of Cupid winged, purchased at the sale of the Right Honourable Edmund Burke's marbles in 1812; and No. 46, a Head of Demosthenes, purchased in 1818.

Beside these, which have been interspersed with the Townley Marbles, King William IV. presented a statue of Venus preparing for the bath, which, together with a statue of the emperor Hadrian, purchased by the trustees in 1821 has been placed in the recently built grand central saloon. A statue of a Faun, in white marble, found at Antium, has since been added to this part of the Museum collection; and in 1840, a bronze statue, the size of life, supposed to represent Eros Apteros, the eyes inlaid with silver, and the nipples with copper, found at Zifteh.

TOWNSHEND, CHARLES, VISCOUNT TOWNSHEND, an eminent statesman in the reigns of George I. and George II., was the second viscount of that name, and was born in the year 1676. The family of the Townshends was a very antient family in Norfolk, and had been settled at Rainham from the middle of the fifteenth century. Sir Horatio Townshend, the father of the subject of this article, had been one of the leading members of the Presbyterian party previous to the Restoration, and having zealously cooperated to bring about that event, was rewarded by Charles II. with the title of Baron Townshend in 1661, and was, in 1682, raised to the rank of viscount. He died in 1686, when his son was only ten years old. On the latter's taking his seat in the House of Lords, when he became of age in 1697, he first acted with the Tories, but very soon attached himself to the Whigs, and especially to Lord Somers. When William III., just before his death, in the beginning of 1702, was endeavouring to form a Whig administration, Lord Townshend had attained sufficient political consequence to be named for the Lord Privy Seal. (Coxe's *Memoirs of Sir Robert Walpole*, vol. i., p. 113, 8vo. ed.)

During the reign of Anne, Lord Townshend was appointed, in 1705, one of the commissioners to treat for the union with Scotland; in 1707, captain of the yeomen of the queen's guard; in 1709, joint plenipotentiary with the duke of Marlborough in the negotiation for peace at Gertruydenberg, and in the same year ambassador extraordinary to the States-General of the United Provinces. In this last capacity he concluded the treaty known by the name of the Barrier treaty, which secured the assistance of the States-General for carrying out the Hanoverian succession, and engaged the endeavours of England to procure in a treaty of peace the Spanish Low Countries as a barrier for the States-General against France. On the dismissal of the Whigs and the formation of the Oxford ministry in 1710, Lord Townshend lost his appointment of captain of the yeomen of the queen's guard.

In the session of 1712 the Commons fell violently on the Barrier treaty, and voted that 'the Lord Viscount Townshend, and all who negotiated and signed, and all who advised the ratifying of the said treaty, are enemies to the queen and kingdom.' This vote was followed up by the Representation to the Queen, in which the treaty was discussed very severely and at length. The Representation may be read in the 'Parliamentary History,' vol. vi., p. 1095; or in Swift's 'History of the Four last Years of the Queen' (*Works*, Scott's edition, vol. v., p. 269).

With the accession of George I., in 1714, there came a complete change of foreign policy; and the persecuted negotiator of the Barrier treaty was now selected to be chief minister of the new king. Lord Townshend had been one of the Lords Justices named by George I., in pursuance of the Act passed in 1706 for securing the succession; and while George was yet at the Hague, on his way to England, he appointed Lord Townshend secretary of state, with the power to name his colleague. On the recommendation of Horace (afterwards Lord) Walpole, his brother-in-law, Lord Townshend named as his colleague General (afterwards Earl) Stanhope. [STANHOPE, JAMES, EARL.] Lord Townshend had been recommended to George by Bothmar, his agent in England, and with Bothmar's recommendation the praises of all the principal statesmen at the Hague had concurred.

Lord Townshend had now been twice married. His first wife was Elizabeth, the second daughter of Thomas, Lord Pelham, and half-sister of the subsequent duke of Newcastle. After her death he married, in 1713, Dorothy, sister to Sir Robert Walpole.

The administration formed under Lord Townshend was entirely Whig. Charles II. on the Restoration, and William and Anne, on their respective accessions to the throne, had pursued the plan of combining the leading members of opposite parties in the ministry: but during Anne's reign party warfare assumed a more determined character, and her last ministry, that of Lord Oxford, had consisted exclusively of Tories. This monopolizing precedent was now turned to the advantage of the Whigs. Lord Townshend was prime minister, though this name had not yet come to be established; and Walpole, who in a short time approached him in influence in the ministry, held at first only the subordinate post of paymaster of the forces, but after the death of Lord Halifax, in the next year, became chancellor of the exchequer and first lord of the treasury. [WALPOLE, SIR ROBERT.]

The principal acts of Lord Townshend's ministry were the impeachments of the principal members of that which had preceded, and the Septennial Bill. The latter measure is a standing reproach against its Whig authors; and though the objection, so often urged, to the power of parliament to prolong the existence of the then sitting House of Commons is on the face of it absurd, the reproach is in other respects deserved. Archdeacon Coxe states that Lord Townshend and Walpole were opposed to the impeachment of Lord Oxford for high treason, and strongly recommended the more judicious course of charging him with high crimes and misdemeanours. (*Memoirs of Sir Robert Walpole*, vol. i., p. 126.)

The Scotch rebellion took place at the latter end of 1715. When the participation of Sir William Wyndham in the preparatory intrigues was discovered, his relationship to the duke of Somerset, an influential Whig nobleman, and a member of the cabinet, caused a difficulty about arresting him, which the firmness of Townshend surmounted. The scene in the council on this occasion is minutely described by Archdeacon Coxe. (*Id.*, p. 128.) 'As the king retired into his closet he took hold of Lord Townshend's hand, and said, "You have done me a great service to-day."'

In the summer of 1716 George visited Hanover, and was accompanied by Stanhope; Lord Townshend remained in England. He had strongly opposed the king's wish of revisiting his native dominions; and even after the repeal of the restraining clause in the Act of Settlement, had reiterated his objections to the king's departure from England. While the king was in Hanover various causes combined to estrange him from the minister in whom hitherto his confidence had been unbounded, and the ultimate result was Lord Townshend's dismissal from office. The causes of this event have been considered at some length by Archdeacon Coxe, in his 'Memoirs of Sir Robert Walpole;' and lately by Lord Mahon, in his 'History of England from the Peace of Utrecht to the Peace of Aix-la-Chapelle' (vol. i., ch. 7, 8). Lord Mahon has made it his object to vindicate the conduct of his ancestor Lord Stanhope in the transactions that led to Lord Townshend's dismissal, and has succeeded in this object, and has also corrected some mistatements in Coxe's account.

Lord Townshend had made himself obnoxious to the king's German mistresses and favourites, whose schemes of avarice and ambition he resisted. His temper was impetuous, and his manner of speaking and writing frank and abrupt, so that if the king was predisposed to take offence, there would be no lack of opportunity. Lord Sunderland, who had aspired to be premier on George's accession, and had deeply resented the precedence given to Townshend in the ministry, joined the king after a time in Hanover, and was too well disposed to join with the German *clique* in undermining Lord Townshend's influence. Subjects of difference between the king and Lord Townshend occurred after the former's going to Hanover. The king, with Hanoverian objects, was eager to declare war against Peter the Great of Russia, a measure which Townshend vehemently resisted. A negotiation was proceeding at the Hague between England, France, and the States-General, for a treaty to secure the successions to the English and French thrones, and for the expulsion of the Pretender from France, which the king and Lord Stanhope in Hanover were anxious to accelerate; and some delays occurred through Lord Townshend, which were attributed to design, owing to disapproval of the way in which the treaty was to be concluded. The king was greatly offended at this, and ordered Stanhope to write a strong reproof to Townshend. He was however appeased by Townshend's reply, in which he fully vindicated himself from the charge of wilful delay. But though this storm blew over, another soon succeeded. The king, anxious to continue in Hanover during the whole winter, had directed Townshend to transmit to him the sentiments of the cabinet on what was to be done in the next session, and on the means of carrying on the business of the country without his own presence. Townshend, to gratify the king's inclination, did not press his return, but strongly urged that a discretionary power should be given to the prince of Wales. The king's jealousy of his son took fright at this recommendation; and it seemed to him to confirm stories which Sunderland had been assiduously spreading of intrigues carried on by Townshend with the duke of Argyll and others for placing the prince of Wales on the throne. The king immediately formed the determination of dismissing Townshend; and it was with much difficulty that Stanhope prevailed upon him to offer the lord-lieutenancy of Ireland by way of breaking the fall. This offer, conveyed by Stanhope, together with the announcement of his dismissal from the secretaryship, was indignantly refused. 'I am highly sensible,' Lord Townshend wrote to the king, 'of the honour which your majesty confers on me by condescending to appoint me lord-lieutenant of Ireland; but as my domestic affairs do not permit me to reside out of England, I should hold myself to be totally unworthy of the choice which your majesty has been pleased to make, if I were capable of enjoying the large appointments annexed to that honourable office without doing the duty.' (Coxe's *Memoirs of Sir R. Walpole*, vol. i., p. 191.) This was irony aimed at Sunderland, who had been lord-lieutenant from George I.'s accession, and had never visited Ireland. Sir Robert Walpole wrote to Stanhope, who had urgently solicited his mediation with Townshend, to prevail on him to accept the lord-lieutenancy:—'When you desired me to prevail with my lord Townshend to acquiesce in what is carved out for him, I cannot but say you desired an impossibility; and 'tis fit you should know that there is not one of the cabinet council with whom you and Lord Sunderland have agreed in all things for so many years, but think that, considering all the circumstances and manner of doing this, nobody could advise him to accept of the lieutenancy of Ireland. . . . . And be assured that whoever sent over the account of any intrigues or private correspondence betwixt us and the two brothers, or any management in the least tending to any view or purpose but the service, honour, and interest of the king—I must repeat it, be assured, they will be found, pardon the expression, confounded liars from the beginning to the end.' (*Id.*, vol. i., p. 310.) And in another letter to Stanhope, whose conduct on this occasion was misapprehended, not perhaps unnaturally, by Townshend and Walpole, the latter made this pointed appeal:—'What could prevail on you to enter into such a scheme as this, and appear to be the chief actor in it, and undertake to carry it through in all events, without which it would not have been undertaken, is unaccountable. I do swear to you that Lord Townshend has no way deserved it of you. . . . . Believe me, Stanhope, he never thought you could enter into a combination with his enemies.' (*Id.*, p. 310.) Stanhope had concurred in the king's resentment against Townshend, when he was supposed to be purposely delaying the French treaty, and had showed his feeling by immediately tendering his resignation, which the king refused. But having been satisfied that his suspicions against Townshend on this occasion had been unjust, he now had borne no other part than to transmit the king's commands, and to endeavour to conciliate him towards Townshend, and soften his determination. The king had conceived a disgust, Stanhope wrote in his first letter on the subject to Sir Robert Walpole, at Townshend's temper. The falsehoods told him of Townshend's intrigues with the prince, of which Stanhope naturally said nothing, but with which there is no evidence to connect him, drove the king into a fury. And the determination which the king had come to under the influence of those violent personal feelings it was impossible to alter. Stanhope wrote to Methuen, who sided with Townshend and Walpole, though he had been destined to succeed Townshend:—'If you have any interest or credit with them, for God's sake make use of it upon this occasion. They may possibly unking their master, or (which I do before God think very possible) make him abdicate England, but they will certainly not force him to make my lord Townshend secretary.' (*Id.*) The king's desire to consult the interests of the Whig party had led him, though with some reluctance, to adopt Stanhope's suggestion of offering Townshend the lord-lieutenancy; and now, when he found the degree of resentment felt by Walpole and many of the leading Whigs, led him also to keep the appointment open till his return to England, in the hope that Townshend might yield. Stanhope saw a gleam of Townshend's return to his former post, if he would first accept the lord-lieutenancy; and he wrote to Walpole, January 16, 1717:—'Believe me, dear Walpole, when I swear it to you, that I do not think it possible for all the men in England to prevail upon the king to re-admit my lord Townshend into his service, upon any other terms than of complying with the offer made of Ireland. The king will exact from him this mark of duty and obedience.' (*Id.*, p. 319.) It was not unnatural that Townshend and Walpole, at a distance from the scene of the intrigues against them, indignant at the false charges of which they heard, and astounded at the strong step to which the king had, without giving any notice, had recourse, should attribute to Stanhope a share in the cabal against them; and such was the opinion of the public.

The effect of Lord Townshend's dismissal, when it was made known, on the public mind and on the Whig party, was such, that the king took fright, and on his arrival in England sent Count Bernsdorf to Lord Townshend to tell him, that having taken away the seals, though perhaps on false reports and too hastily, he yet could not with due regard to his own character at once restore them to him, and to beg Townshend to accept the lord-lieutenancy as a temporary office, to be exchanged hereafter for another more influential one. Townshend now yielded, and those who had sided with him in the ministry were satisfied. But the union thus effected did not last long. Stanhope and Sunderland had acquired an ascendency with the king from which they were now not to be deposed by Townshend and Walpole. These showed their mortification by cold support in parliament of the ministerial measures. On the motions for granting a supply against Sweden, on the 9th April, 1717, almost all Townshend's personal friends voted against the ministry, which narrowly escaped a defeat by a majority of four. The next day Townshend received a dismissal from his office of lord-lieutenant of Ireland. Walpole immediately tendered his resignation, which, it is said, the king received with so much surprise and sorrow, that he returned the seals to him ten times before he would finally accept them. [WALPOLE, SIR ROBERT.] The example of Walpole was followed by Methuen, Pulteney, the secretary at war, Lord Orford, and the Duke of Devonshire.

Lord Townshend now went into opposition, and, like Walpole, is open to the charge of having out of office opposed principles and measures which he had previously supported. In the differences between the king and the prince of Wales, he and Walpole were now the friends of the latter. A reconciliation having been brought about between the king and prince of Wales, in April, 1720, Lord Townshend was admitted a few days after, with the Duke of Devonshire, Lord Cowper, Walpole, Methuen, and Pulteney, to kiss the king's hands; and received more decided proofs of restoration to the king's favour by being appointed in June one of the lords justices, on the king's going to Hanover, and president of the council. Walpole was appointed at the same time paymaster of the forces. The breaking up of the South Sea scheme and the death of lords Stanhope and Sunderland, led in 1721 to a reconstruction of the ministry, in which Lord Townshend became again secretary of state, and Walpole also resumed his old posts of first lord of the treasury and chancellor of the exchequer. Walpole had now attained to a more influential position in the country, and was considered prime minister.

Townshend and Walpole had now again complete influence with the king. Lord Carteret, who was the other secretary of state, beginning, together with Count Bernsdorf, to intrigue against Townshend, did not find success as Lord Sunderland had done in former days. When the king went again to Hanover, Townshend now took care to accompany him, and Lord Carteret accompanied him also. 'The superior influence of Townshend and Walpole,' says Archdeacon Coxe, 'was not solely gained by court intrigues or by the corruption of German favourites, and was not prostituted by a preference of Hanoverian interests to those of England. In the midst of these cabals, the conduct of the brother ministers was firm and manly, moving in direct opposition to the king's prejudices and the wishes of the German junta. Townshend prevented the adoption of violent measures against Russia, proposed by Bernsdorf and seconded by Carteret, which, if pursued, must have involved England in hostilities with the Czar; and he exultingly informed Walpole that the king continued true to his resolution of signing no paper relating to British affairs but in his presence.' (*Memoirs of Sir R. Walpole*, vol. ii., p. 160.) Lord Carteret was removed from the secretaryship of state in 1724, and made lord-lieutenant of Ireland. The duke of Newcastle, the brother of Townshend's first wife, succeeded him; and eventually became, what Carteret had been, Townshend's rival. There soon arose also a coolness between Townshend and his other brother-in-law, and old friend and colleague, Walpole, owing, it is supposed, to their altered positions and Townshend's jealousy of Walpole's growing superiority. It was not until 1730 that the breach between the two brother ministers, and Lord Townshend's resignation, took place: but there were symptoms of a rising misunderstanding as early as 1725, two years before the death of George I. Walpole does not appear to have been to blame in the beginning.

On George II.'s accession, in June, 1727, Lord Townshend's pre-eminence was fully established; and it was owing entirely to his influence that Townshend was retained in the secretaryship. During this year Townshend had a dangerous illness, which was expected to be fatal; and when he was supposed to be dying, Walpole wrote, that he considered him 'the bulwark of the constitution,' and that he trusted 'Providence would interfere to save the man without whom all must fall to the ground.' (Coxe's *Memoirs of Sir R. Walpole*, vol. ii., p. 182.) But Walpole's generous conduct was destined to be fruitless.

In the year 1729 Walpole and Townshend had become determined opponents in the ministry, and Walpole, having the support of Queen Caroline, who was all-powerful with the king, had no difficulty in always gaining the victory over Townshend. Almost every question that arose became a subject of dispute. The duke of Newcastle and Walpole endeavoured to bring Lord Harrington into the cabinet: Lord Townshend brought forward a rival candidate in Lord Stanhope, afterwards the celebrated earl of Chesterfield. Lord Townshend's object was defeated. Dr. Maty has related the following anecdote in his 'Memoirs of Lord Chesterfield' (p. 112): 'The first time he' (Lord Chesterfield) 'appeared at court on his return to London, Sir Robert Walpole took him aside and told him, "I find you are come to be secretary of state." "Not I," said his lordship, "I have as yet no pretensions, and wish for a place of more ease. But I claim the garter. . . . I am a man of pleasure, and the blue riband would add two inches to my size." "Then I see how it is," replied Sir Robert, "it is Townshend's intrigue, in which you have no share; but it will be fruitless, you cannot be secretary of state, nor shall you be beholden for the gratification of your wishes to anybody but myself."' Disputes arose also between Townshend and Newcastle on an important question of foreign policy. Townshend had advised strong measures against the emperor, and had obtained the consent of the king to a despatch directing an invasion of the Austrian Netherlands. He went out of town to Norfolk for a short time, and in his absence Newcastle, with the aid of Walpole and the queen, had brought the king to approve of a contrary policy. Townshend now determined to resign. Angry words, and even blows, passed between him and Walpole before he did so. A particular account of their quarrel is given by Archdeacon Coxe, in his 'Memoirs of Sir Robert Walpole.'

Lord Townshend's resignation took place on the 15th of May, 1730. He retired immediately to his seat at Rainham, and, never again returning to London, devoted himself to agricultural pursuits for the remainder of his life. He introduced the cultivation of the turnip from Germany into this country. Lord Chesterfield visited him in his retirement, to press his coming to London to be present at an important debate, and Lord Townshend refused, saying that he remembered Lord Cowper, though a staunch Whig, had been betrayed by personal pique into voting with the Tories, and he added, 'I know I am extremely warm, and I am apprehensive, if I should attend the House of Lords, I also may be hurried away by the impetuosity of my temper to adopt a line of conduct which, in my cooler moments, I may regret.' 'He left office,' says Lord Mahon, 'with a most unblemished character, and, what is still less common, a most patriotic moderation. Had he gone into opposition, or even steered a neutral course, he must have caused great embarrassment and difficulty to his triumphant rival. But he must thereby have thwarted a policy of which he approved, and hindered measures which he wished to see adopted. In spite of the most flattering advances from the opposition, who were prepared to receive him with open arms, he nobly resolved to retire altogether from public life. He withdrew to his paternal acres at Rainham, where he passed the eight remaining years of his life in well-earned leisure or in agricultural improvements.' (*History of England from the Peace of Utrecht*, &c., vol. ii., p. 208.)

Lord Townshend died on the 21st of June, 1738, in his sixty-third year. He was an able and honest minister, but his ability and honesty were unfortunately uncontrolled by temper or prudent tact. He was not conspicuous as an orator. Lord Chesterfield has left a description of his speaking which is not altogether flattering. 'The late Lord Townshend always spoke materially, with argument and knowledge, but never pleased. Why? His diction was not only inelegant, but frequently ungrammatical, and always vulgar; his cadences false, his voice unharmonious, and his action ungraceful. Nobody heard him with patience; and the young fellows used to joke upon him, and repeat his inaccuracies.' (*Letters*, vol. ii., p. 318.)

TOWNSHEND, RIGHT HONOURABLE CHARLES, was the second son of the third viscount Townshend, by Audrey, only child of Edward Harrison, Esq., governor of Madras, and grandson of the subject of the preceding article. He was born in 1725. He entered the House of Commons in 1747, and very soon gave earnest of his future distinction. He supported the Pelham administration, and was selected to move the address on the opening of the session in November, 1749, of peace after the full establishment by the treaty of Aix-la-Chapelle. The Marriage Bill, introduced in 1753, was opposed by Townshend in a speech of singular power and beauty, which, happily combining humour, argument, and eloquence, fixed his reputation as a debater. An excellent report of the speech has been preserved, and is printed in the 'Parliamentary History' (vol. xv., p. 58). Lord Hillsborough, who replied to Townshend, began his speech by remarking, 'I am very sensible of the danger I am in, when I rise up to speak after the honourable gentleman who spoke last; his manner of speaking is so engaging, there is such a music in his voice, that it pleases the ear, though it does not inform the understanding; at the same time he expresses his sentiments in such beautiful terms, is so ingenious in finding out arguments for supporting his opinion, and states those arguments in so strong a light, that he is always most deservedly heard with attention, and even with a sort of prejudice in favour of everything he says' (*Id.*, p. 62). This is a clear and decisive testimony to the position which Townshend had now taken in the house, and to that eloquence, of which Flood, comparing Townshend with Barré, Conway, and others, towards the end of his career, observed, 'He is the orator; the rest are speakers.' (*Charlemont Correspondence*, p. 27.)

Townshend's speech on the Marriage Bill has been commemorated by another contemporary, Horace Walpole, earl of Orford. 'A second adversary appeared against the bill. This was Charles Townshend, second son of my lord Townshend, a young man of unbounded ambition, of exceeding application, and, as it now appeared, of abilities capable of satisfying that ambition, and of not wanting that application: yet to such parts and such industry he was fond of associating all the little arts and falsehoods that always depreciate, though so often thought necessary by a genius. He had been an early favourite of Lord Halifax, and had already distinguished himself on affairs of trade, and in drawing plans and papers for that province: but not rising in proportion to his ambition, he comforted himself with employing as many stratagems as had ever been imputed to the most successful statesman. His figure was tall and advantageous, his action vehement, his voice loud, his laugh louder. He had art enough to disguise anything but his vanity. He spoke long, and with much wit, and drew a picture with much humour at least, if not with much humility, of himself and his own situation, as the younger son of a capricious father, who had already debarred him from an advantageous match. "Were new shackles to be forged to keep young men of abilities from mounting to a level with their elder brothers?"' Lord Orford proceeds to draw a comparison between Townshend and Conway, who also distinguished himself on the same side in this debate, and to speculate on their future careers. 'What will be their fates I know not, but this Mr. Townshend and Mr. Conway seemed marked by nature for leaders, perhaps for rivals, in the government of their country. The quickness of genius is eminently with the first, and a superiority of application; the propriety and amiableness of character with the latter. One grasps at fortune; the other only seems pleased to accept fortune when it advances to him. The one foresees himself equal to everything; the other finds himself so, whenever he essays. Charles Townshend seems to have no passion but ambition; Harry Conway not even to have that. The one is impetuous and unsteady; the other cool and determined. Conway is indolent, but can be assiduous; Charles Townshend can only be indefatigable. The latter would govern mankind for his own sake; the former, for theirs.' (*Last Ten Years of the Reign of George III.*, vol. i., p. 296.)

In the changes in the administration which followed the duke of Newcastle's death in 1754, Townshend received the appointment of a lord of the Admiralty. On the duke of Newcastle's resignation in November, 1756, and the formation of a ministry by the duke of Devonshire, with Mr. Pitt as secretary of state, Townshend was appointed to the lucrative post of treasurer of the chamber. There are some letters in the lately-published 'Correspondence of Lord Chatham,' which show the importance that was attached at this time to Charles Townshend's support, and the trouble taken to secure him (vol. i., pp. 181, seq.) Townshend demanded the place of cofferer, a lucrative post in the household. This was already engaged. The treasurership of the chamber was then offered, and represented as 'in every respect exactly equal to the cofferer.' Lord Bute went to Townshend, and not finding him, to Townshend's brother, afterwards marquis of Townshend, to press his acceptance of this office, and, with the aid of the Prince of Wales's name, succeeded in satisfying him.

This ministry was but short-lived. Pitt resigned in the spring of next year, in consequence of the dismissal of Lord Temple, and Townshend resigned also. Townshend refused offers to join the new ministry, which Lord Waldegrave had been commissioned to form. After some months of fruitless negotiations, the king was obliged to return to Pitt, and in the ministry formed by him as premier, in June, 1757, Townshend resumed his post of treasurer of the chamber.

In March, 1761, Townshend was appointed secretary-at-war. The next year, Lord Bute's ascendency having led to the resignations of Pitt and Lord Temple in the first instance, and shortly after of the dukes of Newcastle and Devonshire, an offer was made to Townshend of the secretaryship of the plantations, which he refused. Mr. Nuthall writes to Lady Chatham, October 14, 1762:—'My countryman the right honourable Charles Townshend was yesterday sent for by the earl of Bute, who opened to him this new system, and offered him the secretaryship of the plantations and board of trade, which he not only refused, but refused all connection and intercourse whatsoever with the new counsellor, and spoke out freely. He was afterwards three times with the king, to whom he was more explicit, and said things that did not a little alarm. On his coming out of the closet, Mr. Fox met him and gave him joy: he asked, "For what?" Mr. Fox replied, "Of your being secretary of state for the plantations." Mr. T. answered, "Don't believe that, Sir, till you hear it from me." Mr. Fox was struck, and said he was greatly astonished, for he had understood that this had been settled.' (*Correspondence of the Earl of Chatham*, vol. iii., p. 183.) Townshend however supported in parliament the preliminaries for the peace, but soon after was among the opposition to Lord Bute's ministry. On Lord Bute's resignation, in 1763, it was rumoured that Townshend was to be offered the place of first lord of the Admiralty. He was afterwards appointed first lord of trade and the plantations. In the fruitless negotiations which took place with Mr. Pitt towards the close of the year, Townshend was one of those named by Pitt to the king. (*Chatham Correspondence*, vol. iii., p. 265.)

Mr. Grenville's Stamp Act, introduced early in 1765, was zealously supported by Charles Townshend in a speech which elicited from Colonel Barré, in reply, one of his most successful parliamentary efforts. Townshend had concluded with the words, 'And these Americans, children planted by our care, nourished by our indulgence, protected by our arms until they are grown to a good degree of strength and opulence, will they grudge to contribute their mite to relieve us from the heavy load of national expense which we lie under?' 'They planted by your care!' cried Colonel Barré: 'No, your oppressions planted them in America;' and so he went on, overthrowing each clause of the peroration. (Gordon's *History of the American Revolution*, vol. i., p. 160.) Under Lord Rockingham's administration, formed in July, 1765, Townshend held the place of paymaster of the forces. It appears from a letter of Mr. Conway's, who was secretary of state and leader of the House of Commons in this administration, that the posts held by him had been offered to Townshend, and refused by him. Afterwards, with a vacillation characteristic of him, and by which he acquired the name of *the weathercock*, he repented his refusal, and was willing to sacrifice the superior profits of paymaster for the greater honour of secretary and leader. 'C. T., with all his cordiality, fixes conditions to his good will: "confidence and the cabinet" were the words a little while ago; now he wishes to be useful, and the way in which he can be so most is as leader of the House. I closed at once, with the addition that he should then be secretary of state too. . . . . To-day I have privately heard that he has said in a letter that things were changed since he refused.' (*The Companion to the Newspaper*, 1835, p. 365, where there are several extracts from Conway's unpublished letters.) Townshend, who carried his vacillation into his public conduct, and the effect of whose brilliant talents has been lessened, both for his time and for posterity, by the versatility of his politics, now supported the repeal of the Stamp Act, which he had helped the previous session to introduce. Shortly after the formation of the Rockingham administration, he had been detained in the country by illness, which many supposed to be a cloak for dissatisfaction with the new arrangements, and with the position in which he found himself. A pleasant newspaper skit upon this circumstance has been preserved by Lord Chesterfield (*Letters*, vol. iv., p. 263):—'We hear that the Right Honourable Charles Townshend is indisposed, at his house in Oxfordshire, of a pain in his side; but it is not said in which side.'

The Rockingham administration died in July, 1766, 'having lasted,' as Burke has chronicled it, in his 'Short Account of a late Short Administration,' 'just one year and twenty days.' In the new administration formed by Pitt, now created Lord Chatham, Townshend was chancellor of the exchequer and leader of the House of Commons. There had been difficulty, as before, in prevailing upon him to give up his lucrative post of paymaster: he first said he would do so, and then said he would not; but the firmness of Lord Chatham kept him to his first statement. The letters which passed on the subject between Lord Chatham, the duke of Grafton, the king, and Townshend, may be seen in the 'Chatham Correspondence,' vol. iii., pp. 458-63.

The course of this Chatham administration is well known. Lord Chatham was soon too ill to transact any business or exercise any control over his colleagues, who quarrelled with one another, and among whom Townshend was looked upon as presuming and contumacious. Townshend insisted, as chancellor of the exchequer, on a tax being laid on the American ports. If this were not done, he declared, the duke of Grafton wrote to Lord Chatham March 13, 1767, 'he would not remain chancellor of the exchequer.' 'His behaviour on the whole,' adds the duke, 'was such as no cabinet will, I am confident, submit to.' (*Chatham Correspondence*, vol. iii., p. 232.) And on the same day Lord Shelburne writes to Lord Chatham,—'I was surprised at Mr. Townshend's conduct, which really continues excessive on every occasion, till I afterwards understood in conversation that he declared he knew of Lord North's refusal, and from himself. . . . It appears to me quite impossible that Mr. T. can mean to go on in the king's service.' (*Id.*, p. 235.) The policy of Townshend prevailed, and on the 2nd of June he introduced into the House of Commons those unfortunate resolutions imposing duties upon glass, paper, tea, and certain other articles imported into America, which rekindled rebellion in the colonies, and eventually led to their separation from the mother-country. This was done under the nominal premiership of Lord Chatham, the determined opponent of American taxation, but who was now kept by illness aloof from business, and had not been consulted. Soon the necessity of constructing a new administration with an efficient head was perceived, and a negotiation between the marquis of Rockingham, the duke of Bedford, and the duke of Newcastle having failed, it was understood that Charles Townshend was to be entrusted with the formation of a ministry. When the highest power in the state was then just within his grasp, he was suddenly carried away by a putrid fever, on the 4th of September, 1767.

The talents and character of Charles Townshend have been embalmed in a splendid passage in Mr. Burke's celebrated speech on American taxation. The orator had already passed in review Mr. Grenville and his Stamp Act, and the repeal of that act during Lord Rockingham's ministry, and having come to Lord Chatham's administration, and the policy of Charles Townshend, so abhorrent to the tenour of Lord Chatham's principles, he proceeds:—'For even then, Sir, even before this splendid orb was entirely set, and while the western horizon was in a blaze with his descending glory, on the opposite quarter of the heavens arose another luminary, and for his hour became lord of the ascendant. This light too is passed and set for ever. You understand, to be sure, that I speak of Charles Townshend, officially the reproducer of the fatal scheme, whom I cannot even now remember without some degree of sensibility. In truth, Sir, he was the delight and ornament of this House, and the charm of every private society which he honoured with his presence. Perhaps there never arose in this country, nor in any country, a man of a more pointed and finished wit, and (where his passions were not concerned) of a more refined, exquisite, and penetrating judgment. If he had not so great a stock as some have had, who flourished formerly, of knowledge long treasured up, he knew better by far than any man I ever was acquainted with how to bring together within a short time all that was necessary to establish, to illustrate, and to decorate that side of the question he supported. He stated his matter skilfully and powerfully. He particularly excelled in a most luminous explanation and display of his subject. His style of argument was neither trite and vulgar nor subtle and abstruse. He hit the House just between wind and water; and not being troubled with too anxious a zeal for any matter in question, he was never more tedious or more earnest than the preconceived opinions and present temper of his hearers required, to whom he was always in perfect unison. He conformed exactly to the temper of the House; and he seemed to guide, because he was always sure to follow it. . . . . There are many young members in the House (such of late has been the rapid succession of public men) who never saw that prodigy Charles Townshend, nor of course know what a ferment he was able to excite in everything by the violent ebullition of his mixed virtues and failings,—for failings he had undoubtedly; many of us remember them; we are this day considering the effect of them. But he had no failings which were not owing to a noble cause; to an ardent, generous, perhaps an immoderate passion for fame; a passion which is the instinct of all great souls. He worshipped that goddess wheresoever she appeared; but he paid his particular devotions to her in her favourite habitation, in her chosen temple, the House of Commons. . . . . He was truly the child of the House. He never thought, did, or said anything, but with a view to you. He every day adapted himself to your disposition, and adjusted himself before it as at a looking-glass.'

Townshend had married Caroline, the daughter and heiress of John, second duke of Argyll and Greenwich, and widow of the earl of Dalkeith, eldest son of the duke of Buccleuch. Just before his death, while his influence was in the ascendant, he obtained for his wife the title of Baroness Greenwich. Townshend selected Adam Smith as tutor and travelling companion for his step-son the young duke of Buccleuch [SMITH, ADAM], having been first led to this choice, we are informed by a letter of Mr. Hume's, by his admiration of the 'Theory of Moral Sentiments.'

TOWNSHIP. This term is sometimes used to denote the inhabitants of a town in their collective capacity. In legal signification it is a vill forming part of a parish in cases where a parish has been divided for secular purposes into several vills or townships.

TOWNSON, THOMAS, D.D., was the eldest son of the Rev. John Townson, rector of Much Lees, in Essex, where he was born in 1715. After the usual preparatory education, conducted partly at home, partly at school, he was sent to the university of Oxford, where he was entered a commoner of Christ Church, in March, 1733. In July, 1735, he was elected a demy (or scholar) of Magdalen College; in 1736 he was admitted to the degree of B.A.; in 1737 he was elected a Fellow of Magdalen; and in June, 1739, he commenced M.A. In December, 1741, he was ordained deacon, and in September, 1742, priest, by Dr. Secker, bishop of Oxford. Immediately after this he set out, accompanied by Mr. Dawkins, Mr. Drake, and Mr. Houldsworth, on a tour through Italy, Germany, and Holland, from which he did not return till 1745. Having resumed his residence at the university, he was, in 1746, presented by his college to the living of Hatfield Peverell, in Essex, which he retained till 1749, when he resigned it on being presented, by Sir Walter Wagstaffe Bagot, Bart., to the rectory of Blithfield in Staffordshire. This year he was senior proctor of the university; soon after his quitting which office he was admitted to the degree of B.D. He resigned his fellowship in January, 1751, on being instituted to the living of the lower mediety of Malpas, in Cheshire, to which he was presented by his friend Mr. Drake, but which he did not accept without some reluctance, arising principally from his unwillingness to leave Oxford.

In 1758, having received, under the will of the Rev. William Barcroft, rector of Fairsted and vicar of Kelvedon in Essex, a bequest of above 8000*l.*, together with his library, he resigned Blithfield, and having now more leisure, he began to apply himself with greater assiduity to literary pursuits in connection with his profession. The first work which he finished was an Exposition of the Apocalypse, which however was never printed. His first publication was an anonymous pamphlet, entitled 'Doubts concerning the Authenticity of the last Publication of the Confessional, addressed to (Dr. Blackburne) the author of that learned Work,' 8vo., 1767. This was followed, in 1768, by 'A Defence' of the 'Doubts,' and by another pamphlet, entitled 'A Dialogue between Izaac Walton and Homologistes; in which the Character of Bishop Sanderson is defended against the author of the Confessional.'

In 1768 he made a second tour to the Continent with Mr. Drake's eldest son, Mr. William Drake, of Brasenose College. In 1778 he published his principal work, his 'Discourses on the Four Gospels,' 4to., which immediately attracted great attention; and in testimony of the merit of which the university of Oxford conferred upon the author, in February, 1779, the degree of D.D. by diploma. A German translation of this work appeared at Leipzig, in 2 vols. 8vo., in 1783. In 1780 Dr. Porteus, then bishop of Chester, bestowed upon Dr. Townson the archdeaconry of Richmond. In 1783 the divinity chair at Oxford was offered to him by Lord North, the chancellor, but his advanced time of life induced him to decline accepting it. He died 15th April, 1792. Dr. Townson's collected works were published, in 2 vols. 8vo., in 1810, under the care of Mr. (afterwards Archdeacon) Churton, together with a Memoir of the author, from which the above facts are extracted. In addition to the productions that have been mentioned above, this collection contains some single sermons, and a portion of a treatise on the Resurrection, entitled 'A Discourse on the Evangelical Histories of the Resurrection and First Appearance of our Lord and Saviour Jesus Christ,' a few copies of which, in 4to., had been printed by the author in 1784, and distributed among his friends. Dr. Townson was as highly distinguished by the virtues of his private character as for his professional learning and ability.

TOXICODENDRON. [RHUS.]

TO'XODON (*τόξον*, a bow; *ὀδοὺς*, a tooth—from the curvature of the teeth), Professor Owen's name for an extinct genus founded on *Toxodon Platensis*, a gigantic mammiferous animal, referrible to the order PACHYDERMATA, but with affinities to the RODENTIA, EDENTATA, and *Herbivorous Cetacea*.

Mr. Darwin, during his sojourn in Banda Oriental, having heard of some giants' bones at a farm-house on the Sarandis, a small stream entering the Rio Negro, rode there and purchased, for the value of eighteen pence, the cranium now in the museum of the Royal College of Surgeons in London, and the subject of Professor Owen's description. The people at the farm-house told Mr. Darwin that the remains were exposed by a flood having washed down part of a bank of earth. When found, the head was quite perfect; but the boys knocked the teeth out with stones, and then set up the head as a mark to throw at. Mr. Darwin found a perfect tooth, which exactly fits one of the sockets in this skull, embedded by itself on the banks of the Rio Tercero, at the distance of about 180 miles from the farm-house. Near the *Toxodon* Mr. Darwin found what he terms the fragments of the head of an animal rather larger than the horse, and which he describes as having some points of resemblance with the *Toxodon* and others, perhaps with the *Edentata*. These fragments, now also in the Museum of the College, Professor Owen has ascertained to belong to the lower jaw of *Toxodon*. Mr. Darwin observes that the remains appeared so fresh as to render it difficult to believe that they had lain buried for ages underground. The bone contained so much animal matter, that when heated in the flame of a spirit-lamp it not only exhaled a very strong animal odour, but likewise burned with a slight flame. (*Journal.*) The place where the remains were found is bout 120 miles north-west of Monte Video, and the cranium was embedded in a whitish argillaceous earth forming the banks of the Sarandis.

The first notice of this most interesting discovery appears in the 'Proceedings of the Geological Society of London,' and the paper by Professor Owen was read on the 19th of April, 1837.

The Professor premised his anatomical description by an abstract from Mr. Darwin's account[*] of the geological structure of the district in which the cranium was found. The foundation of the whole surrounding country is granitic, but covered, often to a considerable thickness, by a reddish argillaceous soil containing small calcareous concretions.

The cranium equals that of the HIPPOPOTAMUS in size, measuring 2 feet 4 inches in length, and 1 foot 4 inches in extreme breadth. The form of the skull is elongated, depressed, and chiefly remarkable for the strength and wide expanse of the zygomatic arches, and the aspect of the occipital foramen and occipital region of the skull, which slopes from below upwards and forwards. The maxillary portion of the skull is compressed laterally, narrow, and with large intermaxillary bones slightly dilated at their extremity.

The teeth consist of molars and incisors. The latter are four in number in the upper jaw, the two middle ones very small, the two external ones very large, curved, and with their sockets extending backwards in an arched direction through the intermaxillary bones to the maxillary, and terminating, without diminishing in size, immediately anterior to the grinding-teeth, where the large persistent pulps of these incisors were lodged. In form and relative size these teeth must have resembled the *dentes scalprarii* of the Rodents.

The molar teeth no less present a close approximation in their form and structure to the molar teeth of the herbivorous rodents: they are seven in number on each side of the upper jaw, and, from the form of the sockets, appear to have corresponded with each other in structure.

After this description of the teeth, the form, proportions, disposition, and connections of the different bones of the cranium are pointed out, and the structure of the osseous cavities subservient to the organs of sense is adverted to, followed by deductions that the habits of the *Toxodon* were aquatic.

So far as the form and position of the external aperture of the bony nostrils, of the occipital condyles, together with the slope of the occipital region, are concerned, the same arguments, the Professor observes, might be advanced for referring the *Toxodon* to the mammiferous group containing the Dugong, as had been urged in reference to the DINOTHERIUM; but the existence of air-cells or sinuses in the superior parietes of the *Toxodon's* cranium show, he adds, that the cranial characters above alluded to are not conclusive as to the cetaceous nature of the animal. The general conclusions respecting the affinities of the *Toxodon* to existing orders of mammals are then summed up.

In the *Zoology of the Beagle* (1838) the subject is treated by the Professor in greater detail, and richly illustrated: among the illustrations is a figure of the cranium, of the natural size. Our limits will not permit us to follow out these satisfactory details, which should be attentively perused, and we proceed to give the summary, which is nearly the same in substance as that at the end of the abstract in the 'Proceedings of the Geological Society.'

'After summing up the different affinities, or indications of affinity,' says Mr. Owen, 'which are deducible from this most curious and interesting fossil mammal, we are led to the conclusion, assuming it to have had extremities cased in hoofs, that it is referrible to the order Pachydermata. But the structure, form, and kind of teeth in the upper jaw, prove, indisputably, that the gigantic Toxodon was intimately related to the Rodent order. From the characters of this order, as afforded by the existing species, the Toxodon however differs in the relative position of the supernumerary incisors, and in the number and direction of the curvature of the molars. If moreover the lower jaw, next to be described, belong, as I believe, to the Toxodon, the dental character of the genus will be—

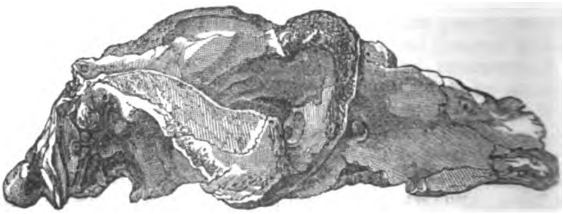
'*Incisores* $\frac{4}{6}$; *pro laniariis diastema; molares* $\frac{7-7}{7-7}$

'The Toxodon again deviates from the true Rodentia, and resembles the Wombat [MARSUPIALIA, vol. xiv., p. 463] and the Pachyderms in the transverse direction of the articular cavity of the lower-jaw. It deviates from the Rodentia, and resembles the Pachydermata in the relative position of the glenoid cavities and zygomatic arches, and in many minor details already alluded to.

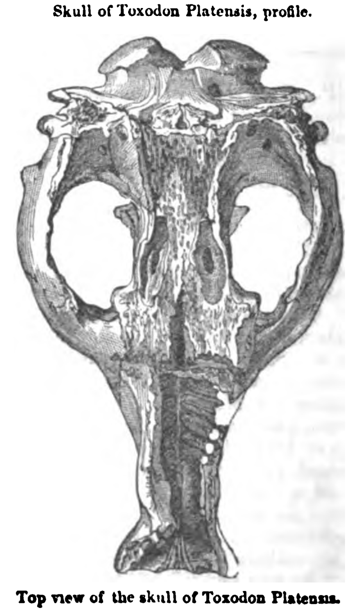
'In the aspect of the plane of the occipital foramen, and occipital region of the skull—in the form and position of the occipital condyles—in the aspect of the plane of the anterior bony aperture of the nostrils—and in the thickness and texture of the osseous parietes of the skull, the Toxodon deviates both from the Rodentia and existing Pachydermata, and manifests an affinity to the Dinotherium and Cetaceous order, especially the Herbivorous section.

'At present we possess no evidence to determine whether the extremities of the Toxodon were organized on the ungulate or unguiculate type, nor can we be positive, from the characters which the skull affords, that the genus may not be referrible to the *Mutica* of Linnæus, although the development of the nasal cavity and the presence of large frontal sinuses render it extremely improbable that the habits of this species were so strictly aquatic as the total absence of hinder extremities would occasion.

'Where the dentition of a mammiferous animal is strictly carnivorous, this structure is obviously incompatible with a foot incased in a hoof; but where the teeth are adapted for triturating vegetable substances the case is different. If animals so characterised are of small size, and seek their food in trees, or if they burrow for roots or for shelter, the vegetable type of dentition must co-exist with unguiculate extremities, as in the Edentata and Rodentia generally; but the largest genus [HYDROCHŒRUS] of the Rodent order, whose affinity to the Pachydermata is manifested in its heavy shapeless trunk, thinly scattered bristly hair, and many other particulars, has each of its toes inclosed in a miniature hoof.



Skull of Toxodon Platensis, profile.



Top view of the skull of Toxodon Platensis.

'The affinity above alluded to is too obvious to have escaped popular notice, and the Capybara, from its aquatic habits, has obtained the name of Water-hog. It is highly interesting to find that the continent to which this existing aberrant form of Rodent is peculiar should be found

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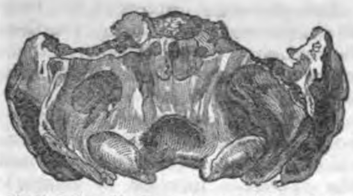
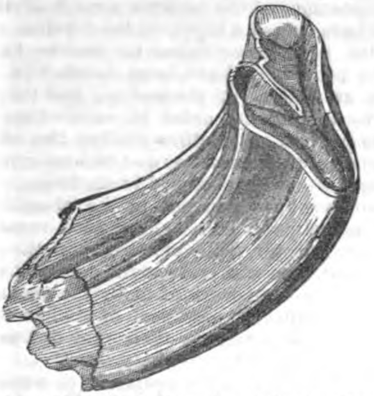
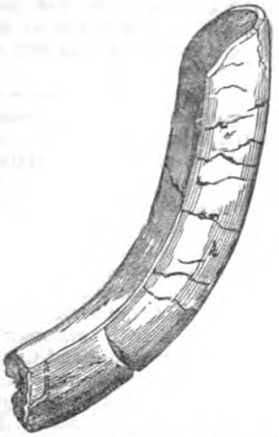
[*] Mr. Darwin's paper, entitled 'A Sketch of the Deposits containing the extinct Mammalia in the neighbourhood of the Plata,' was read to the Society on May 3, 1837.



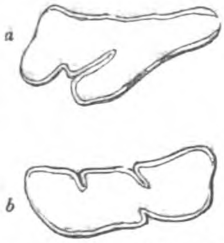
Skull of Toxodon Platensis, seen from behind.



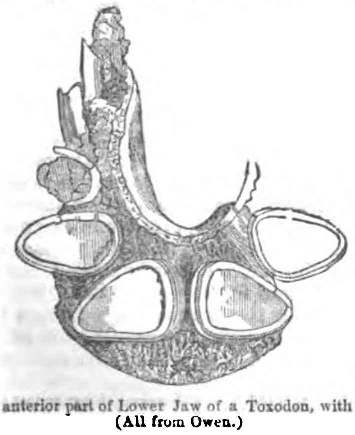
Penultimate Molar Tooth, Upper Jaw, of Toxodon Platensis.



Incisor Tooth of Lower Jaw of a Toxodon.



a, Grinding Surface of penultimate Upper Molar Tooth of Toxodon Platensis.
b, Grinding Surface of a corresponding Molar Tooth of the Lower Jaw.



Fragment of anterior part of Lower Jaw of a Toxodon, with teeth in situ.
(All from Owen.)

to contain the remains of an extinct genus characterised by a dentition which closely resembles the Rodent type, but manifesting it on a gigantic scale, and tending to complete the chain of affinities which links the Pachydermatous with the Rodent and Cetaceous orders.'

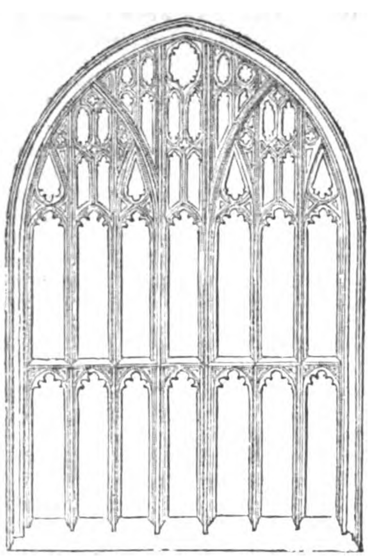
Professor Owen then enters upon the description of the lower jaw, or rather the fragments of the one above alluded to, found also by Mr. Darwin at Bahia Blanca, in lat. 30°, on the east coast of South America. The inquiry is conducted in the most cautious and philosophical manner, and leaves no doubt that the fossils in question are the fragments of a lower jaw and teeth of a *Toxodon*, belonging, if not to *Toxodon Platensis*, at least to an allied species.

TOXO'STOMA, Wagler's name for a genus of THRUSHES.

TRACERY, a term of uncertain origin, perhaps of modern invention, but exceedingly useful and almost peculiar to our own architectural vocabulary, there being no corresponding term in any other language to denote with equal brevity and clearness that species of pattern-work formed or *traced* in the head of a Gothic window by the mullions [MULLION] being there continued, but diverging into arches, curves, and flowing lines, enriched with foliations. The term is also applied to ornamental design of the same character, whether for doors, panelling, or ceilings; the only difference being that in windows the pattern or tracery is perforated, and in other cases closed, that is, is a mere pattern carved on the surface of a solid part; except in particular instances, where the tracery on parapets, battlements, turrets, spires, &c. is pierced, and then it is described as *open-work*. The latter term necessarily implies tracery of some kind or other, though 'tracery' does not imply 'open-work,' the latter being merely an exception from the usual mode.

Much both of the beauty and character of the Gothic or pointed style depends upon windows and their tracery; and it is one great and peculiar merit of the style, that such indispensable apertures for the admission of light are made to constitute some of its most striking features, and to exhibit very forcibly the pervading principle of the entire system. This is so strongly marked, that it is incomprehensible how in making any attempt at Gothic the veriest bungler could fail to perceive how essential mullions and tracery are to the character of the style, and that to omit them in what professes by the general form of the aperture to be a Gothic window, is just like omitting the capital of a Corinthian column. Neither is it sufficient that the mere general outline and pattern of tracery and mullions be followed, for that may be done, and nevertheless the character be lost—at least greatly impoverished, and rendered mean, meagre, and wiry, as is generally the case more or less in modern Gothic windows and tracery.

On referring to GOTHIC ARCHITECTURE, p. 323, it will be seen that Tracery does not occur in the simple lancet style or earliest form of Gothic, for there the windows consist merely of so many single apertures, placed side by side, and united only by their external mouldings, instead of being included within a larger arch. The first principle followed was therefore rather of *addition* than of *combination;* but as soon as the latter idea was adopted, it necessarily led to the continuation of the window by perforating the *tympanum*, or space between the smaller arches and the larger one over them. At first this was usually done by filling up the *head* of the window with a single circle cut into foils, and with the open spandrels or smaller triangular spaces so produced. Of such windows an example from Westminster Abbey is shown at the page above referred to, and on the following one are other instances where tracery of the same character becomes more elaborate and complicated, either by the circle being repeated, as in the example from York, or subdivided into smaller ornamental compartments, as in that from Exeter. This species of tracery is distinguished by the name of *Geometrical*, while that which succeeded it is termed *Flowing* from its being composed throughout of curved lines interwoven with each other, after the manner of the example from Kirton, which is shown along with the others above mentioned. In *Perpendicular* tracery, on the contrary, the lines of the mullions are continued in the head of the window, and divide it into panels, which are in turn subdivided into smaller ones. The annexed is a specimen of such window, from St. Mary's Church, Oxford.



What is called *Flamboyant* tracery is a species of the *Flowing* peculiar to French Gothic, and is remarkable not only for its richness and intricacy, but for its irregularity, the pattern of the separate compartments not being perfectly symmetrical, although one half of the window corresponds with the other. To the above-mentioned varieties may be added another peculiar to Germany, but not very common there; this has obtained the name of *Stump* tracery, in consequence of some of the mouldings appearing to be broken off, and leaving only short ends or stumps where they intersect other lines.

Tracery of the same character admits of very great diversity of design, and that not only in different buildings, but in the same building, although such source of variety is rarely turned to account by modern architects. It has however been done by Mr. Pugin in the Catholic church now building in St. George's Fields, London, in which edifice all the windows exhibit different patterns of tracery.

TRACHELI'PODA (τράχηλος, *trachelos*, a neck; and ποὺς, *pous*, gen. *podos*, a foot), Lamarck's name for his third order of the class *Mollusca*.

Lamarck divides the order into two sections:—

1st section. Phytiphaga. Plant-eaters.

Div. 1. Air-breathers.

Families:—Colimaceans (*Helix*, &c.), Limneans (*Limnæa*, &c.).

Div. 2. Water-breathers.

Families:—Melanians, Peristomians, Neritaceans, Janthinians, Macrostomians, Plicacians, Scalarians, Turbinacians.

2nd section. Zoophaga. Flesh-eaters, Water-breathers, and all marine.

Families:—Canalifera, Alatæ, Purpurifera, Columellaria, Convolutæ. (*Animaux sans Vertèbres*.)

Fossil Carnivorous Trachelipods.

Professor Buckland, in his *Bridgewater Treatise*, remarks that most collectors have seen upon the sea-shore numbers of dead shells in which small circular holes have been bored by the predaceous tribes for the purpose of feeding upon the bodies of the animals contained within them: similar holes, he observes, occur in many fossil shells of the Tertiary strata, wherein the shells of carnivorous Trachelipods also abound; but perforations of this kind are extremely rare in the fossil shells of any older formation. In the green-sand and oolite, he adds, they have been noticed only in those few cases where they are accompanied by the shells of equally rare carnivorous mollusks; and in the lias and strata below it there are neither perforations nor any shells having the notched mouth of perforating carnivorous species.

'It should seem from these facts,' continues the Professor, 'that in the economy of submarine life the great family of carnivorous trachelipods performed the same necessary office during the tertiary period which is allotted to them in the present ocean. We have further evidence to show that in times anterior to and during the deposition of the chalk the same important functions were consigned to other carnivorous mollusks, viz. the Testaceous Cephalopods, consisting of the chambered shells of Nautili and Ammonites, and many kindred extinct genera of polythalamous shells of extraordinary beauty. The molluscous inhabitants of all these chambered shells probably possessed the voracious habits of the modern cuttle-fish, and, by feeding, like them, upon young testacea and crustacea, restricted the excessive increase of animal life at the bottom of the more antient seas. Their sudden and nearly total disappearance at the commencement of the tertiary era would have caused a blank in the "police of nature," allowing the herbivorous tribes to increase to an excess that would ultimately have been destructive of marine vegetation, as well as of themselves, had they not been replaced by a different order of carnivorous creatures, destined to perform in another manner the office which the inhabitants of Ammonites and various extinct genera of chambered shells then ceased to discharge. From that time onwards we have evidence of the abundance of carnivorous Trachelipods, and we see good reason to adopt the conclusion of Mr. Dillwyn, that "in the formations above the chalk the vast and sudden decrease of one predaceous tribe has been provided for by the creation of many new genera and species possessed of similar appetencies, and yet formed for obtaining their prey by habits entirely different from those of the Cephalopods."'

TRACHEO'TOMY is the operation of cutting into the trachea. It is sometimes also called Bronchotomy; and a similar operation on the lower part of the larynx is named Laryngotomy. The anatomy of the parts principally concerned in these operations will be found in the articles Larynx and Respiration.

Tracheotomy may be performed for several purposes; as, to form an aperture either for the admission of air into the lungs, when the larynx, fauces, or upper parts of the air-passages are obstructed, or for the extraction of foreign bodies from the adjacent parts of the air-passages, or for the facility of inflating the lungs in suspended animation. In the first view it may be necessary in many diseases; such as croup, acute laryngitis, œdema of the glottis, severe cases of quinsy, tumours and other growths in the larynx or pressing on it; in all of which the aperture through the glottis is frequently closed, not merely by the swelling of the membranes around it, or the enlargement of the adjacent parts, but by the spasmodic and fixed contraction of the muscles whose office it is to approximate the vocal ligaments. The relief afforded by the operation is often instantaneous, and, for a time, complete; but its ultimate results are less certain, for though it may be sufficient to prevent the impending suffocation, it has no influence in arresting the original disease. On the contrary, the operation itself is not without danger; and that, both from the accidents that may occur in its performance, and from its subsequent effects: and therefore, although no general rule can be laid down, its performance should not be undertaken unadvisedly, nor in any cases in which it is not absolutely and almost immediately necessary for the preservation of life.

In its performance a vertical incision is first made in the median line of the throat, either below the thyroid gland, or more or less above it, according to the circumstances of the case and the object to be accomplished. The dissection must then be continued carefully onwards in the same direction, pushing aside the sterno-hyoid muscles, and whatever vessels lie in or near the middle line, till the trachea is completely exposed. When the hemorrhage has ceased, or is but slight, the trachea must be opened, first by a vertical incision, and then by removing portions of one or more of its rings, according to the size of the aperture that is required. Through the opening a short silver canula must be introduced, and, as often as is rendered necessary by mucus accumulating in it, must be removed, cleaned, and again introduced. The means to be subsequently adopted must vary with the circumstances of each case: if the obstruction is removed, the wound in the trachea may be healed, but if not, the canula must be worn for the rest of life. If the operation were performed for the removal of a foreign body, or for the inflation of the lungs, no canula need be introduced, but the wound should be closed as soon as the main object is attained.

TRACHENCHY'MA. [Tissues, Vegetable.]

TRACHYTE, the name of a pyrogenous rock, extremely abundant among the products of modern volcanoes, and composing whole mountains in countries where igneous action is very slightly or not at all perceived. It is essentially a felspathic rock, and amongst other peculiarities often contains cracked crystals of felspar. It is porphyritic (including large crystals of felspar) in the Siebengebirge, granular or earthy. Mr. Scrope (*Journal of Science*, vol. xxi.) has given a convenient synopsis of the principal varieties of Trachyte, distinguishing them by the nature of their composition.

A. Compound trachyte, with mica, hornblende, or augite, and grains of titaniferous iron.
B. Simple trachyte, containing only felspar.
C. Quartziferous trachyte, with numerous crystals of quartz.
D. Siliceous trachyte, more than usually quartzose.

The equivalent rocks among old Plutonic or trappean masses are those which have principally a felspathic constitution, as the porphyritic rock of Drumadoon in Arran, the 'claystone' of the Pentland hills, the 'Elvans' of Cornwall and Cumberland. The term trachyte is from the Greek trachys (τραχὺς), 'rough,' expressing the 'feel' of this volcanic rock. [VOLCANO.] (Daubeny, *On Volcanoes*.)

TRACHYTELLA, a genus of plants of the natural family of Dilleniaceæ, so named from τραχυτης, roughness, because the leaves are remarkable for their asperity. The genus belongs to the tribe Delimaceæ, of the above family, by having the sepals and petals from 4 to 5, numerous stamens, and 1 or 2 baccate many-seeded carpels. The known species are only two in number, natives of China and Cochin-China, climbing in habit, with racemes of white flowers. The leaves of T. Actæa have so very rough a surface, that they are employed in Canton for polishing both wood and metal.

TRACTION, in Mechanics, is the act of drawing a body along a plane, usually by the power of men, animals, or steam; as when a vessel is towed on the surface of water or a carriage moved upon a road. The power exerted in order to produce the effect is called the force of traction.

Numerous experiments have been made for the purpose of ascertaining the value of a force so exerted; and when men are employed to draw laden boats on canals, it is found that if the work be continued for several days successively, of eight hours each, the force of traction is equivalent to a weight of 31¼ lbs., moved at the rate of two feet per second, or 1⅓ mile per hour (it being understood that such weight is imagined to be raised vertically by means of a rope passing over a pulley, and drawn in a horizontal direction). The force of traction exerted when, without moving from his place, a man pulls horizontally against a weight so suspended, is estimated at 70 lbs. The action of a horse in drawing a vessel on a canal is said to be equivalent to a weight of 180 lbs. raised vertically, as above supposed, with a velocity of 3⅔ feet per second, or 2½ miles per hour; but this estimate has been considered too high; and from experiments which have been made on the power of horses in waggons, carts, and coaches, on level ground, it is found that the force of traction exerted by a stout horse is equivalent to 80 lbs. raised at the rate of 4⅖ feet per second, or 3 miles per hour. Mr. Tredgold considers that a horse exerts a force of traction expressed by 125 lbs. raised at the rate of 3⅔ feet per second, or 2½ miles per hour. A man or a horse can however double his power of traction for a few minutes without being injured by the exertion; and when the carriage is in motion, so that the friction on the ground is alone to be overcome, a horse can draw, during a short time, on a level road, a weight exceeding 1500 lbs.

The force of traction is found to vary nearly with the term $(w-v)^2$, where w is the greatest walking velocity of a man or horse when unresisted (6 feet per second, or 4 miles per hour, for a man; and 10 feet per second, or 6⅚ miles per hour, for a horse), and v is the velocity with which the vessel or carriage is moved. From theoretical considerations it has been determined that the greatest effect is produced when the velocity of the object moved is one-third of that with which the man or animal can walk when unresisted.

If a wheel-carriage were situated on a level plane which opposed no resistance, it is evident that, whatever were the diameter of the wheels, the smallest conceivable power of traction applied to the axle would suffice to put the carriage in motion. But when a wheel in moving meets with an obstacle on the ground, that obstacle is pressed at the point of contact by a force acting in the direction of a line drawn to it from the centre of the wheel, and arising from that part of the weight which is supported by the wheel, together with the force of traction; therefore by the 'resolution of forces,' the ratio between the resistance which is to be overcome by the moving-power and the weight on the wheel will become less as the diameter of the wheel is increased: also the most advantageous direction in which the force of traction can be exerted is perpendicular to the line of pressure drawn from the centre of the wheel to the obstacle. But the height of the wheels cannot exceed certain limits depending on the use to which the carriage is applied; and when the latter has four wheels, the height of those which are in front must be such only as will allow it to be turned round within a given space; also, when a horse is employed to move a carriage, attention must be paid to the conditions under which his power may be advantageously exerted.

It was first observed by M. Deparcieux, and published in the 'Mémoires de l'Académie des Sciences,' 1760, that horses draw heavy loads rather by their weight than by their muscular force. Dr. (Sir David) Brewster has also remarked that when the resistance is great a horse lifts both its fore-feet from the ground; then, using his hinder-feet as a fulcrum, he allows his body to descend by its weight, and thus overcomes the obstacle: and it may be added that when this action takes place with a two-wheeled carriage, if the loading is disposed so that some portion of it may press on the horse's back the effect of the animal's weight will thereby be increased. Now if the traces, or the shafts of the carriage, were attached to the horse's collar near his centre of gravity, a line imagined to be drawn from the latter point to his hinder-feet may represent his weight, and a line drawn perpendicularly from his feet upon a plane passing through the traces or shafts may represent the lever of resistance: but while the former line remains the same, this lever becomes less as the plane of traction (that of the traces or shafts) inclines more upwards from the wheel; and therefore, in order that the power of the horse may be advantageously applied, the diameter of the wheel should be as small as is consistent with other circumstances.

Experiments have shown that when the angle of traction, as it is called, that is, the angle which the plane of the traces makes with the road on which the carriage is moving, is 15 or 16 degrees, a horse pulls with good effect; and the height of the points at which the traces are attached to a horse's collar being about 4 feet 6 inches from the ground, it follows that, in order to obtain this inclination, the lower extremities of the traces or shafts should be 2 feet 3 inches from the ground. In general however, in two-wheeled carriages, the height of these extremities is about 3 feet.

As an example of the force of traction exerted by steam, it may be stated that on a level line of railway, an engine with an 11-inch cylinder, and having an effective pressure of 50 lbs. per square inch in the boiler, drew 50 tons at the rate of 30 miles per hour, working 10 hours daily; and that the same engine, with an equal pressure in the boiler, drew 160 tons at the rate of 15½ miles per hour. (Pambour *On Locomotive Engines*.)

TRACTRIX, or **TRACTORY**, the name given to a curve described by a heavy point attached to a string, the other end of which is moved along a given straight line or curve. For some account of this curve, which is of no interest except as a mathematical exercise, See Peacock's Examples, page 174.

TRADE, BOARD OF. The department of the English government popularly known under this title is a committee of the Privy Council, and its proper designation, which correctly defines its principal functions, is—'The Lords of the Committee appointed for the consideration of all matters relating to Trade and Foreign Plantations.' This department is practically under the direction of a president and vice-president, the other members of the Board or Committee are,—the Lord Chancellor, the Archbishop of Canterbury, the First Lord of the Treasury, the Three Principal Secretaries of State, the Chancellor of the Exchequer, the Speaker of the House of Commons, the Chancellor of the Duchy of Lancaster, the Paymaster of the Forces, the Treasurer of the Navy, the Master of the Mint, and such officers of state in Ireland as are privy councillors in England; but those functionaries do not ordinarily interfere with or assist at the deliberations of the president and vice-president. The clerks of the council are, *ex-officio*, secretaries of the Board of Trade, but that duty is performed by two joint-assistant secretaries.

The president and vice-president of the Board of Trade exercise, in effect, the duties which in other countries are performed by the minister of commerce. Their office is not indeed executive, but rather consultative, the orders rendered necessary by their decisions being given by the Lords of the Treasury or by the secretary of state, as the case may require. A great part of the business connected with the government of the colonies, which used formerly to be transacted in this department, has of late years been transferred to the secretary of state for the colonial department, but all laws passed by colonial legislatures must receive the formal sanction of the Board of Trade before they are assented to by the crown.

Besides the matters of government connected with commerce which are brought under the consideration of the Board of Trade by direct application from merchants or other parties interested, all questions of that character which come before the executive branches of the government should be referred to the Board for its opinion. In addition to this the legislature has provided that its sanction shall be required in order to legalise the exportation of machinery, and recently it has placed under its control the regulation of all the railways in the kingdom, so far as the management of the same may involve the safety of the public. The department for receiving returns of the prices of corn within the kingdom and for declaring thereupon the rate of duty chargeable upon foreign grain imported, is likewise attached to the Board of Trade, and in 1832 a department was newly created under the control of the president and vice-president, for collecting and arranging statistical information, with a view to its presentation to parliament.

TRADE-WINDS is the term used by seamen to indicate the perpetual or constant winds, because they promote more than any other circumstance navigation and trade. These perpetual or trade winds occur in all open seas on both sides of the equator, and to the distance of about 30 degrees north and south of it. They were not known to the antients, and seem to have been unknown even to modern seamen up to the time of Columbus. Though before his time Portuguese navigators had proceeded as far as the Cape of Good Hope, they had not ventured to any great distance from the coast of Africa, and consequently they had not entered the regions where the trade-wides blow. Columbus however, who had passed some time at the Canaries, to which the trade-winds extend in summer, seems to have conceived a just idea of their extent. On his first voyage, after leaving the Canaries, his crew were greatly alarmed at finding that the wind always blew from the north-east and east, and feared that they would be prevented by it from returning to their native country. Columbus did not participate in their fears, and on his return from the newly discovered islands his track was north of the trade-winds, in the region of the variable winds. After the time of Columbus, European navigation extended rapidly in the Atlantic and Indian oceans, and the trade-winds became generally known. It does not however appear that any attempt to explain this phenomenon was made before the time of Galileo, who, in adopting the system of Copernicus and the revolution of the earth round its axis, thought he found some confirmation of this opinion in the trade-winds, which, as he conjectured, owed their origin to the revolution of the earth and to the circumstance that the atmosphere, though it participated in that motion, could not follow with equal speed the motion of the dense parts of our planet, and that a motion in the air was thus produced which was contrary to that of the earth round its axis, or from east to west. The strongest proof in favour of this hypothesis was the circumstance that the trade-winds occur only in the lower latitudes, where the surface of the earth in its revolution round its axis has to make a large circle in twenty-four hours, and consequently must move with a greater degree of rapidity than in the higher latitudes. The opinion of Galileo was generally adopted up to 1686, when Halley's hypothesis was published in the 'Philosophical Transactions.' Halley had collected more extensive information respecting these winds, and soon discovered several facts, which were incompatible with the opinion of Galileo. The two most decisive were, that there are no trade-winds near the equator, where the diurnal motion of the earth is greatest, and that the trade-winds change their position according to the seasons, which could not take place if they were only the effect of the rotation of the earth.

The facts respecting the trade-winds, which had been collected by Halley, have not been materially increased in number since his time, but they have been exactly determined. The trade-winds are met with on both sides of the equator. The mean boundary-line of the region in which they blow, and beyond which variable winds prevail, is about 28° lat. in the eastern parts of the ocean, but in the western parts this line is generally two or three degrees farther north and south. To the north of the equator they blow in the eastern parts of the ocean from the north-east, seldom from the eastward of east-north-east, or from the northward of north-north-east. In proceeding farther west they become more easterly, and often they blow from due east, and sometimes from the south of east, but generally they are one or two points north of east. To the south of the equator the trade-winds in the eastern parts of the ocean blow from south-east, and usually between south-east and east, but they also decline more to due east in reaching the western portion of the ocean. They do not occur in the vicinity of the continents, but are chiefly separated from them by a tract of sea in which either periodical or variable winds prevail. The trade-winds therefore are only experienced when we are well out from the land in the open sea. The wind blows with less force and steadiness in the eastern than in the western portion of the ocean. It is also stronger and more constant in the hemisphere where the sun is not, than in that which is exposed to its perpendicular rays; in the latter however it is more easterly than in the former. The region in which the trade-winds occur is distinguished by an almost continual serenity and fair weather. Though the trade-winds of the northern and southern hemisphere blow in an oblique direction towards one another, they do not meet in general, but are divided by a tract of sea in which calms frequently prevail, and also variable light winds, mostly from the west, are met with. This region of the calms is distinguished by a thick foggy air, and frequent rains of short duration attended by thunder and lightning. The region of calms which separates the north-east trade-winds from the south-eastern, and which usually occupies a width of four or five degrees of latitude, is not always found at the same part of the ocean, but advances farther north when the sun has a northern declination, and farther south when it is in the southern hemisphere. The same is observed respecting the winds themselves. Though the mean boundary-line of the trade-winds is 28° of lat. in the eastern parts of the ocean, it extends two, three, and even four degrees farther north when the sun approaches the northern tropic, and about the same distance farther southward when the sun is near its greatest southern declination. It sometimes happens that a north-eastern wind occurs as far north as 40° in the Atlantic, along the southern coasts of Spain and Portugal, but as this is seldom the case, it is supposed that such a wind cannot be considered as a trade-wind, but only as one of the variable winds which prevail to the north and south of the trade-winds. There are also a few instances on record in which the north-east and south-east trade-winds have not been found separated by a region of calms, but in which a vessel, with the intervention of a calm of short duration, has passed from one trade-wind into the other.

The theory of Halley rests on the well established principle that wind is only a current of air or a part of our atmosphere in a state of more or less rapid motion, and that its principal cause is a partial or local rarefaction of the air by heat. When the air is heated, it becomes specifically lighter, and in this state ascends: the less rarified or colder air rushes into its place to restore the equilibrium, and thus forms a current of air, or what is properly called a wind. The rarefaction produced in our atmosphere by the apparent diurnal progress of the sun is the origin of the trade-winds. It appears that the heat caused by the sun in the air is strong enough to produce this rarefaction to an extent of about 60 degrees of latitude, as the trade-winds, including the region of calms, extend over nearly such a portion of the globe. In this immense space the rarefied air is replaced by the colder and denser air which rests over the region contiguous to the region of the trade-winds, and this transposition of air is the trade-wind. As the difference of the density of the two currents of air which come in contact is not great, the wind is of moderate force. If the wind could move with a degree of velocity equal to the progress of the sun, it would blow from the north on the north of the places which are under the influence of the perpendicular rays of the sun, and from the south on the southern side of such places. But the velocity of the wind is infinitely less than that of the earth. Hence it follows that the wind has hardly taken the direction which is imparted to it by the rarefaction of one place, when the place of the greatest rarefaction has already changed, having proceeded farther west. This makes the direction of the wind decline to the place of greater rarefaction, and thus the northern wind is converted into a north-eastern and the southern into a south-eastern wind. If we further consider that this process in the atmosphere is rapidly extending westward when not interrupted by the intervention of high land, we easily conceive that the quick progress of the rarefaction towards the west must insensibly influence still more the direction of the wind, and hence it is found that in the western portions of the ocean and also near the equator the trade-winds blow nearly from due east.

The trade-winds, both in their direction and limits, incline towards the sun, or place of greatest rarefaction; that is, when the sun is near the northern tropic, or returning from it, having heated the northern hemisphere, the south-east trade-wind declines farther from the east point than in the opposite season, and blows with strength towards the place of greatest rarefaction; and its northern limits reach nearly to, and in some places beyond, the equator. The north-east trade-wind at the same time inclines nearer to the east point than in the other season, blowing with less strength, and becoming contracted in its southern limits, which then recede several degrees, sometimes 14 or 15 to the north of the equator. In the opposite season, when the southern hemisphere is greatly heated by the sun, the north-east trade-wind blows stronger, declines farther from the east point, and approaches nearer the equator: the strength of the south-east trade-wind at the same time is considerably diminished by the influence of the sun, and approaches some points nearer to the east point.

Thus all the phenomena of the trade-winds are satisfactorily explained by the theory of Halley, with the exception of the region of calms. No satisfactory explanation has been offered for this phenomenon. Kämtz, in his 'Manuel of Meteorology,' contents himself with saying, 'In the space between the two trade-winds the air is heated to the highest degree. There the ascending currents of air are the most rapid; and by this quick ascent the velocity of the wind blowing along the surface of the sea is greatly diminished. Besides it would seem that the upper and lower current of the air come into contact with one another at a comparatively small elevation above the surface of the globe. These two circumstances appear to be the reason why no regular winds are met with within the region of the calms.'

This explanation of Kämtz, the value of which we do not venture to determine, refers to a principle of the theory of Halley which has not yet been mentioned. According to this principle the heated and rarefied air rises above the more dense portion of the atmosphere; and when arrived at a certain elevation above the surface of the globe, it is condensed by the cold, but being unable to return to its former place, which has been occupied by a colder air from another place, it flows towards the poles, or rather towards those parts which have supplied the air to the rarefied places. This expanse of the upper air takes a direction opposite to that of the trade-winds, namely, to the north-west, from which quarter the greater part of the air had been derived, which occupied its place within the trade-winds: thus two currents of air are found within the limits of the trade-winds, of which the lower runs to the south-west north of the equator, and to the north-west south of it, and the upper in the opposite direction. In this manner a kind of atmospherical circulation is formed, which is admirably adapted for the preservation of animal life. The existence of this counter-current of air in the upper regions had only been inferred from the theory, and nothing could be adduced to prove it, except that within the trade-winds the clouds, which rarely make their appearance in this region, generally take a direction which corresponds to that of the supposed current of air. But in 1812 an event took place which was rather more decisive in favour of the theory. In the eruption of the volcano of St. Vincent, considerable quantities of ashes and other volcanic matter descended on and spread over the island of Barbadoes. This event certainly excited a high degree of surprise, as in this part of the Columbian Sea the trade-wind always blows with a considerable force, so that vessels sailing from St. Vincent to Barbadoes are obliged to make a circuitous course of some hundred miles to reach the place of their destination. It can hardly be questioned that the volcanic matter was raised by the eruption of the volcano to such an elevation that it reached the counter-current, which, blowing from the west, carried it to Barbadoes. Humboldt adduces also in support of the theory the strong south-western wind which he experienced at the top of the Peak of Teneriffe, whilst all the other parts of the islands were under the sway of the trade-wind; and this observation is also confirmed by Glass, who, in his 'History of the Canary Islands,' states that during the trade-winds the most elevated parts of those islands experience a continual westerly wind, which blows with considerable force. Lastly, we may adduce in corroboration of the theory the instantaneous change of wind which is frequently experienced when the limits of the trade-winds are passed.

It has been already observed that the boundary of the trade-winds towards the nearest pole does not alway occur in the same part of the ocean, but changes with the seasons. The difference is considerable. At the greatest southern declination of the sun, in December and January, the northern boundary of the north-east trade-wind of the Atlantic occurs to the south of 25° N. lat., whilst in the opposite season, from June to September, it occurs about 32° N. lat. Thus we find a tract of sea, seven degrees of latitude in width, which is alternately exposed to the sway of the trade-winds and of variable winds, and nearly in the middle of this tract the Canaries are situated. These islands therefore are within the trade-winds for six months, and for the remainder of the year without them. Von Buch, in his description of these islands, has given an account of the regular manner in which the trade-wind advances towards the north, with the progress of the sun in the northern hemisphere, and in which it recedes when the sun passes the equator on its return to the southern hemisphere, observing that the south-western wind, which is always found in the upper regions of the atmosphere above the trade-winds, does not make its appearance on the south, as may be inferred from the direction in which it flows, but is first experienced at Madeira, whence it gradually advances to Teneriffe and the other Canaries. Whilst this south-western wind advances from north to south, it also descends by degrees from the upper to the lower regions, and to the surface of the globe. On Teneriffe this takes place in October, when the south-west wind is experienced on all mountains 6000 feet high, but generally one week passes, and sometimes several weeks, before the south-western wind sinks to the level of the sea.

The trade-winds are only met with on the sea; but in some countries of the globe between the tropics, or near them, regular and constant easterly winds occur, which may owe their origin to the same cause. These winds only occur in extensive level plains, where there is nothing to break their force or to change their direction; for if the wind comes in contact with high land or mountains, its regular progress is obstructed. But over a considerable tract of low level land the wind passes without being much changed in its direction and velocity, particularly if the land be barren and destitute of moisture. In the Sahel, or western part of the Sahara, an easterly wind blows all the year round with great force, but in the eastern district of the Great Desert it is less constant and less violent, so that in all respects it may be compared with a trade-wind. An easterly wind is also always found on the plain drained by the Amazonas; and by its assistance the voyage against the strong current of the river may be accomplished nearly in the same time as the voyage downwards by means of the current. Humboldt found that this easterly wind, which near the mouth of the Amazonas is moderate, has acquired such a force at the base of the Andes, that it is almost impossible to keep one's footing against it. A similar easterly wind, though of less strength, is found in the great plain which is traversed by the lower course of the Orinoco.

The countries just mentioned, in which these easterly winds blow constantly, are contiguous to those parts of the Atlantic Ocean where trade-winds in general are regular all the year round. But the trade-wind of the ocean and the land-winds of the plains do not come into contact with one another. They are separated by a tract of the globe in which other winds prevail. This tract lies within the ocean, and extends along the coasts of the continents: its width varies greatly. Where it lies east of the trade-wind it is usually a hundred miles wide, but it is of inconsiderable breadth when the land lies to the west of the trade-winds. The continuity of the easterly winds is evidently interrupted by the difference of the temperature of the air incumbent on the sea and on the land. This difference changes with the seasons, the air over the land being hotter than that of the sea when the sun is near, and colder when it is far off. Hence it follows that during the first period the wind blows from the sea to the land, and in the second from the land to the sea. Thus a kind of monsoon is produced along the coasts of the continents, even within the region of the trade-winds. A large island in such a situation is therefore surrounded by winds blowing from all quarters. When the land of Australia is heated by the presence of the sun in the southern hemisphere, the wind generally blows from the westward upon the north-western coast, and from the south-west upon the western coast; from the south-west, south, and south-east on the southern coast; and from the south-east and east upon the east coast. In the opposite season however the winds are less regular, because the greatest part of the island is then without the reach of the trade-winds.

The trade-winds occur on both sides of the equator in the Atlantic and Pacific oceans, but they vary considerably in extent and force in both oceans. Some account of this difference is given under the heads of ATLANTIC OCEAN (vol. iii., p. 26) and PACIFIC OCEAN (vol. xvii., p. 119). We shall here add, respecting the last-mentioned sea, that the trade-winds in the southern parts appear to be subject to great changes in direction and force, and that they properly occur only along the coasts of South America, where a constant south-easterly wind is met with at the distance of 500 to 600 miles from the coast: but in the middle of the Southern Pacific the trade-wind seems by no means regular and constant. Captain Fitzroy, in speaking of the Paamuto Islands, or the Dangerous Archipelago of the Low Islands, says that among them a steady south-easterly trade-wind prevails from March to October, but that in the rainy season, from October to March, westerly winds, squalls, and rains are frequent; and in the Abstract of his meteorological journal we find that in running from the Galapagos to Otaheite he experienced only south-eastern winds near the equator; and that in the remainder of his voyage the wind blew almost constantly from the north-east, north-north-east, or north-east by east. Kotzebue, on his first voyage, observed it as a remarkable circumstance, that between Easter Island and 14° 51′ S. lat. he met only with winds blowing from north, north-east, and east-north-east. This anomaly in the trade-winds of the Southern Pacific is probably produced by the innumerable islands and coral rocks which cover that ocean between the equator and the southern tropic, and extend from 130° W. long. to the coast of Australia. Horsburgh says, probably from his own observation, that 'where shoal coral-banks shoot up out of the deep water in many places between the tropics, a decrease of the prevailing wind is frequently experienced; for when a steady wind is blowing over the surface of the deep water, no sooner does a ship get upon the verge of a shoal coral-bank than a sudden decrease of the wind is often perceived. This is, in his opinion, occasioned by the atmosphere over these banks being less rarefied by the increased evaporation than that over the deep water, and consequently not requiring so great a supply of air to restore the equilibrium as the circumjacent parts, which are more rarefied and heated.' When such effects, according to the statement of this intelligent hydrographer, are produced by single coral-banks in the midst of the ocean, we may easily comprehend that their number and immense extent in the Southern Pacific not only diminish their force, but change the direction of the trade-winds, and that these reefs and islands affect them nearly to the same extent as a large continent. It appears that in the Southern Pacific the trade-winds are replaced by the north-eastern, northern, and western winds only during the period when the sun is in the southern hemisphere.

A south-eastern trade-wind prevails also in the Indian Ocean from within a few degrees of the eastern side of Madagascar nearly to the coasts of Australia, between the parallels of 10° and 28° S. lat.; but in this ocean from 10° S. lat. to the coasts of Hindustan the winds are periodical. Further particulars are found under MONSOONS (vol. xv., p. 343, &c.).

(Halley, *On the Trade-Winds*, in *Philos. Transactions of the Royal Society*, vol. xvi.; Rennell's *Investigation of the Currents of the Atlantic Ocean*; Humboldt's *Voyage aux Regions Equinoctiales du Nouveau Continent*; Horsburgh's *India Directory*; Von Buch's *Physicalische Beschreibung der Canarischen Inseln*; Kämtz's *Handbuch der Meteorologie*; Fitzroy, in the *Narrative of the Surveying Voyages of the Adventure and Beagle*; Kotzebue's *Voyage of Discovery to the South Sea and Beering's Strait.*)

TRADESCANT, JOHN, the name of two naturalists, father and son, who lived in England during the seventeenth century. John Tradescant, the elder, appears to have been a Dutchman, but the time of his birth and of his arrival in England are equally unknown. He does not appear to have been known to Gerarde, who wrote his Herbal in 1597; but in Johnson's edition of this work, published in 1633, he is frequently alluded to: hence Pulteney concludes that he arrived in England between these periods. In the early part of his life he had travelled in Europe and Asia, and occupied some position in the service of Lord Salisbury During a voyage up the Mediterranean, he made collections of plants in Barbary and on the coasts of the Mediterranean. In 1629 he was appointed gardener to Charles I. It is not known at what period he died. He left behind him a large collection of specimens of natural history, and a garden well-stored with rare and curious plants.

John Tradescant, the younger, was son of the above, and inherited his father's taste for natural history. In the early part of his life he made a voyage to Virginia, and brought from that country a collection of dried plants and seeds. In 1656 he published in 12mo. a little work entitled 'Museum Tradescantium,' or 'A Collection of Rarities preserved at South Lambeth near London.' It contains a descriptive catalogue of his father's museum which he had by his own exertions greatly augmented. This museum contained not only stuffed animals and dried plants, but also minerals, instruments of war and domestic use of various nations, also a collection of coins and medals. This museum is remarkable as containing one of the few specimens ever known of the Dodo, a bird now supposed to be extinct. [DODO.] The catalogue of the museum is accompanied with good engravings of the two Tradescants, and is sought after by print-collectors on this account. The younger Tradescant was intimate with most of the celebrated men of his time, and his collection of natural objects was visited and aided by the most distinguished persons of the day. In 1650 he became acquainted with Mr. Elias Ashmole, who, with his wife lived in his house during the summer of 1652. The result of this was so close a friendship, that Tradescant, who died in 1662, left his museum of natural history to Ashmole It was afterwards bequeathed by Ashmole to the university of Oxford, where it unjustly bears the name of the Ashmolean Museum. The remains of the garden of the Tradescants were still at Lambeth in 1749, when it was visited by Sir W. Watson and described by him in the 46th volume of the 'Philosophical Transactions.' The widow of the younger Tradescant erected a singular and handsome tomb to the memory of father and son, which is still to be seen in the church-yard at Lambeth. The Tradescants introduced many new plants into Great Britain. Amongst others a species of spider-wort thus brought over was called Tradescant's Spider-wort. It has since been formed into the type of a genus with the name Tradescantia, and has a large number of species. [TRADESCANTIA.]

(Pulteney's *Botanical Sketches*; *Diary* of Elias Ashmole, Esq.)

TRADESCA'NTIA, a genus of plants of the natural family of Commelinaceæ, which was so named in honour of the English botanist John Tradescant, who was gardener to Charles I. The museum of the Tradescants was one of the earliest formed in this country, and being left to Ashmole, afterwards became the property of the university of

Oxford, whose name it still bears. The species are natives of America and of India. Many of them, being of a highly ornamental nature, are cultivated in flower-gardens; a few are used medicinally in the countries where they are indigenous. Thus T. axillaris, according to Rheede, is used in India as an application to the abdomen in cases of tympanites; and Martius describes the stem and leaves of T. diuretica as being employed in Brazil as emollient applications in rheumatic pains, intestinal derangements, and in retention of urine; while in North America T. virginica is employed in cases of bites of venomous spiders, as well as some other species, whence it has obtained the name of spider-wort, but it is doubtful whether they possess any other than simple emollient properties. This species is most common in the flower-borders of English gardens. All the species are of comparatively easy culture, where the climate approximates to that of their natural sites.

TRADITION (from the Latin *tradere*) comprises, in the widest sense of the word, all that has been handed down (quae tradita sunt) to us concerning the events of the past, and in this sense all history is tradition. But the different ways in which accounts of past events are handed down produce an essential difference in the accounts themselves, which are accordingly designated by different terms. In the early ages of mankind and of every nation, when the art of writing was unknown or little used, all history was handed down by oral communication from generation to generation without written records. Afterwards when the accounts thus propagated were written down and assumed a definite shape, or many shapes, according to the information, the opinions, or the judgment possessed by the person or persons who wrote them down, such accounts were found to differ materially from accounts written by eyewitnesses at or soon after the times when events happened. Historical criticism distinguishes the two kinds of history by calling the former *tradition*, in a narrower sense of the word, and the latter *history*. The characteristic peculiarity of tradition, in this sense therefore, is that for a time it was transmitted from father to son, or from generation to generation, by oral communication, and was subject to all the influences of such communication until it became fixed by being put into a written shape. Those who know how, even in our days, reports are changed and embellished, how some features are omitted and others added during the process of passing from mouth to mouth, and how in the end they frequently assume a totally different aspect from what they originally had, will readily admit that such traditions cannot be received with the same faith as contemporary history. We may add that the more important the occurrence handed down by tradition is, and the more it affects the feelings and passions of man, the greater will be the changes and corruptions which it experiences in its progress. The desire moreover of seeing things clear and complete is inherent in the human mind; and hence we find that in innumerable instances where a tradition or a series of traditions was deficient, unclear, or incomplete, man's imagination and ingenuity have been at work to make up an apparently complete account, either by filling up the gaps in the original account with pure fictions, or by transferring and combining events which belong to different times and countries. Such accounts require to be examined with more caution on the part of the historian the more skilfully they are made up, and the more their apparent consistency resembles real history. Specimens of traditions of this kind may be found in great numbers in the early history of every nation. It is the business of the historian who feels the want of a positive conviction, and is not satisfied with discovering that a tradition is obscure, inconsistent, or incredible, to find out its historical groundwork, by comparing the traditions about one and the same subject, by analogies, and by separating such additions and embellishments which have been made with a view to satisfy man's curiosity, or his feelings, either religious or political. The historian who undertakes this task has to guard against two dangerous rocks: the one is the desire to construct out of a tradition a history according to a preconceived notion or theory, the very thing which in many cases was the cause of the adulterated tradition itself; and the other is the so-called rationalistic mode of dealing with tradition, which consists in stripping it of everything poetical or marvellous, and leaving nothing but a skeleton, which is considered as history merely because it presents nothing that might not happen every day and within our own experience. It is better simply to accept a tradition than to treat it in either of these ways; for thus we have at least a faithful memorial of the manner in which our ancestors conceived and viewed certain things, whereas in the former case we have little more than dreams or a spectre of history.

In the history of Christianity the term tradition has been applied to the so-called unwritten word of God, that is, to the doctrines said to have been communicated by Christ to his apostles, which were not written down by them, but were handed down by their oral instruction to their successors and were propagated in the church by the bishops, and prevented from becoming corrupt, like other traditions, by the influence of the Holy Ghost. This tradition is preserved in the writings of the ecclesiastical fathers, and the Church of Rome regards them, next to the Bible, as a source of knowledge which ought to regulate the life and religious observances of Christians. She claims for it the same unconditional faith in regard to its divine authority as for the doctrines of the New Testament. This theory has been established by the council of Trent; and the New Testament and tradition are made to go hand in hand, and to exercise a mutual influence upon one another by completing and explaining one another. The substance of the tradition thus revered by the Church of Rome however affects rather the forms of religion than its essence; and some of these forms, such as the baptism of infants, the celebration of certain festivals, and the like, are retained and observed by Protestants, while on the whole they reject tradition, and do not consider it binding.

TRAGACANTH. [ASTRAGALUS.]

TRAGACANTH, familiarly termed *Gum-Dragon*, is the produce of several species of the genus Astragalus, belonging to the section Tragacanthaceæ and subsection Tragacanthæ of Decandolle (*Prod.*, ii. 295). The A. verus (Olivier, *Voyage dans l'Empire Ottoman*, v. 342), a native of the north of Persia, Armenia, and Asia Minor, yields the greater part of what is used in Europe. Persia supplies it likewise to India, Bagdad, and Basrah. A small quantity is also obtained from A. gummifer (Labill.), but this is not marketable in Europe. A. creticus, Lamarck (Tragacantha Cretica incana, Tournefort), yields it sparingly; while, according to Sibthorp (*Prod. Fl. Graecae*, ii. 90), the tragacanth which is used in Italy is obtained in Greece from the A. aristatus (Villars, non L'Heritier, nec Willd., the plant of which last two is a native of the Alps and Pyrenees, and with which Willdenow classes Pallas's A. pseudo-tragacantha, a native of the Caucasus, and which, according to Sibthorp, yields the tragacanth of Dioscorides). The A. tragacantha (var. *a*. Linn.), the A. Massiliensis (Lamarck et Dec.), long reputed to be the source of tragacanth, yields no concrete gum, but merely a gummy juice, which is used in confectionary. In the hot months of July and August, particularly after a dewy or a cloudy night, the branches of A. verus are found encrusted with tragacanth. It is not procured by artificial incisions, but exudes spontaneously from natural clefts in the bark, or from punctures made by insects, or more probably by a subepidermal fungus, like the *nemaspora crocea*, as the shrubs from which the juice exudes are always in an unhealthy state, or ready to perish. (Decandolle, *Phys. Veg.*, i., p. 174.)

In commerce tragacanth occurs in two forms, termed vermiform, and flake or cake tragacanth. The former, called also Morea tragacanth, is not frequent in this country. It is mostly in small twisted threadlike pieces, seldom in flat or bandlike portions, of a variable size, of a whitish colour. The larger irregular pieces often run together, and are of a yellow or yellowish-brown colour. White wormlike pieces are selected and sold as vermicelli. Flake or Smyrna tragacanth occurs in tolerably large, broad, thin pieces, with concentric elevations or lines, seldom of a filiform shape: colour whitish. Both sorts are hard, yet somewhat soft and even flexible before breaking; fracture dull and splintery. It is with difficulty reduced to powder, except in winter, or in a heated mortar. It is devoid of taste and smell. It swells in the mouth, and is lubricous. Fine tragacanth is not rendered blue by iodine, but the Morea tragacanth is affected by it, as well as an artificial substance prepared by boiling starch, which last article, called tragacanthin, does not swell in water. Kutera gum, which is sometimes mixed with or substituted for genuine tragacanth, is not affected by tincture of iodine. It always occurs in stalactite-like pieces, and, consisting almost entirely of bassorin, is scarcely soluble in water. Both tragacanth and Kutera-gum are insoluble in alcohol. According to the analysis of Guerin-Varry (*Journal de Chem. Méd.*, vii. 742), tragacanth consists of

	Soluble part.	Insoluble part.
Carbon	42·01	35·79
Hydrogen	6·42	7·11
Oxygen	54·57	57·10
	103·00	100·00

The soluble part, termed *tragacanthia*, or *adragantin*, though considered identical with that of gum-arabic, and therefore termed *arabin*, differs inasmuch as neither silicate of potash nor perchloride of iron affects it, while alcohol produces a peculiar precipitate. This must be borne in mind in considering Guerin's proximate analysis of it, which is—

Arabin	53·30
Bassorin and starch	33·10
Water	11·10
Ashes	2·50
	100·00

Tragacanth may therefore be considered as a conglomerate of gum, bassorin, starch, and vegetable membrane. It approximates more to starch than common gum, than which it is more nourishing, but less digestible. Tragacanth is to be preferred to gum-arabic to form a mucilage, as one part will inspissate fifty parts of water. It is better to allow pieces of tragacanth slowly to dissolve in cold water than to use the powder with boiling water. Both the mucilage and powder are used to suspend heavy powders in water; also to make lozenges and pills. For electuaries it is improper, as it renders them slimy on keeping. As a demulcent, or means of sheathing the fauces and intestines, it is preferable to gum-arabic, its insolubility rendering it a more efficient protection to the mucous membrane against either acrid poisons or unhealthy secretions. Thus, in India, tragacanth boiled in rice-water is advantageously administered in dysentery and bloody fluxes. Externally, a thick mucilage of tragacanth is a good application to burns, to exclude the air.

In the arts tragacanth is of considerable utility. In Persia and France it is used to stiffen and glaze silk, and in this country it was much employed to stiffen calico. It is now however so greatly superseded by less expensive indigenous mucilages, that in 1839 duty (6*s.* per cwt.) was paid on 87 cwts. only. The inferior kinds are used by shoemakers to glaze the edges of the soles of boots and shoes.

TRAGEDY. [ENGLISH DRAMA.]

TRA'GIA, a genus of plants of the natural family of Euphorbiaceæ, so named in compliment to the name Tragus, borne in science by a German botanist of the name of Bock, which signifies a 'goat,' as does its Greek translation. The species are found in India and in America, are climbing in habit, and some are remarkable for stinging as violently as nettles. T. cannabina, so named from its leaves resembling those of the Cannabis, or hemp, and of which the roots given in infusion are considered diaphoretic and alterative. T. involucrata is a small plant without taste or smell, but the native physicians of India consider it calculated to strengthen the system in cachectic states of the constitution and in chronic cases of syphilis. T. volubilis, which is a stinging climber, and has a very acrid juice, is employed in conjunction with common salt for the destruction of some kinds of ulcers.

TRA'GOPAN. [PHASIANIDÆ, vol. xviii., p. 65.]

TRAGOPO'GON (from τράγος, a 'goat,' and πώγων, 'beard'), a genus of plants of the natural family of Cichoraceæ, which is usually considered only a tribe of the great order of Compositæ. The genus Tragopogon, or Goat's Beard, is so named from the long silky beard or pappus of the seeds. The genus is distinguished by having a simple involucre of many leaves. Receptacle naked. Pappus stalked, plumose. Achenia longitudinally striated. The species are found in the temperate parts of Europe and of Asia. One, *T. gracilis*, is found in the Himalayan Mountains, of which the leaves are eaten by the natives as lettuce is in Europe, but without being blanched. The best-known species however is T. porrifolius, or Salsify, which is occasionally cultivated in this country, but frequently in France and Germany. The English T. pratensis may be cultivated for the same purpose. The roots of Salsify are the parts esteemed; they are long and tapering, their flavour mild and sweetish, and are boiled or stewed like carrots. The stalks of year-old plants are sometimes cut in the spring, and, when similarly dressed, taste like asparagus.

TRAGOS, a genus of zoophyta, apparently allied to Spongia, but as yet found only in a fossil state. (Goldfuss, *Petrificata Eurpoa.*)

TRAGUS HIERO'NYMUS (whose German name was Bock, and whom the French call Le Boucq), a German botanist of the sixteenth century. He was born at Heidesbach in 1498. In early life he received a good education, and became well acquainted with the antient languages. He was appointed master of a school at Zweibrücken; after this he studied medicine, but having embraced the reformed religion, he became a preacher, and was till his death minister at Hornbach. His medical studies directed his attention to the subject of botany, which he pursued with great ardour throughout his life. Up to his time no advances had been made in the science of botany from the times of Pliny and Dioscorides. The Arabian writers had satisfied themselves with copying Greek and Roman writers, and making comments upon them without adding any new observations. Tragus was born at a time when the human mind was beginning to emancipate itself from the thraldom of authority both in science and religion. Instead of taking for granted all that had been written about plants, he commenced observing for himself. The same spirit also manifested itself in his cotemporaries, Brunfels, Fuchs, and Gessner; with these great naturalists he was on terms of intimacy, and the first result of his labours in botany was published in 1531, in a work entitled Herbarium,' by Brunfels, with the name 'Dissertationes de Herbarium Nomenclaturis ad Brunfelsiam.'

In 1539 Tragus published his great work on which his reputation depends. It was written in German, and entitled 'Neu-Kreüterbuch vom Unterschiede, Wurkung und Nahmen der Kreüter, so in Deutschland wachsen,' Strassburg, folio. In all previous modern works on botany the plants had been arranged alphabetically, but in this work Tragus adopted a natural classification, which, whatever may be its defects, has the merit of being the first modern attempt at the classification of plants. He divided the vegetable kingdom into three classes:—1, wild plants with odoriferous flowers; 2, trefoils, grains, potherbs, and creeping plants; 3, trees and shrubs. This classification is of course exceedingly imperfect; it however served to open the way to better systems. He commences his work with a description of the nettle, and for this two reasons are assigned:—1, That he wished to teach persons engaged in the practice of medicine not to despise the meanest plants; and 2, that the nettle was his family badge. The first edition of this work was published without illustrations, but in 1546 an edition was published containing upwards of 300 wood-cuts. To Tragus, Fuchs, and Brunfels belongs the merit of having commenced the illustration of works of natural history with wood-engravings. Haller says that he was 'homo jocularis,' and in his representation of plants this is made evident by the addition of figures illustrative of their medicinal effects. Thus Pyramus and Thisbe are stationed at the foot of the mulberry-tree; Æsop is demonstrating his innocence under a fig-tree; and Noah surrounded by his three sons is chosen as an illustration of the effects of the vine. Many of the wood-cuts were good, and most of them were copied into the various herbals that were published in the sixteenth and seventeenth centuries. The descriptions of the plants are short and somewhat obscure; they were however original, and the structure of plants was but very imperfectly understood in the time of Tragus. He has given the Hebrew and Arabic names of the plants, as well as the Greek and Latin, but in these synonyms he exerted too little care in the identification of the German plants with those of antient writers. Two editions of the engravings of this work with the names of the plants were pub lished at Strassburg by Trew, in 1550 and 1553, under the title, 'Vivæ atque ad Vivum Expressæ Imagines omnium Herbarum in Bock Herbario depictarum Icones solæ,' 4to.

A Latin edition of the Kreüterbuch was published by Kyber in 1552. This edition has a learned preface written by Conrad Gessner. It is sometimes spoken of as a separate work of Tragus. It has for its title, 'Hieronymi Tragi de Stirpium maxime earum quæ in Germannia nostra nascuntur, &c. libri tres in Latinam linguam conversi, interprete David Kyber Argentinensi, Argent.,' 4to. Several editions of the German book have been published; the best of these is that of 1695, which was edited by Melchior Sebitz and Nicolas Agerius. Tragus died at Hornbach in 1554.

(Haller, *Bibliotheca Botanica;* Adanson, *Familles des Plantes; Biog. Univ.*)

TRAJAN'S COLUMN, a celebrated work at Rome, which has served as a precedent rather than as a model for other triumphal or honorary pillars. [Trajanus.] The idea of employing a column for such purpose—probably derived from Egyptian obelisks [Obelisk]—seems to have been first adopted by the Romans, but neither manifests much invention nor regard to propriety. An obelisk is evidently complete in itself; is not intended to bear any support, or to be kept steady by it, but is calculated to stand by itself. A column, on the contrary, is only a member of a structure, detached from which and from its entablature it has no meaning nor any particular grace, being apt to look tottering and 'top-heavy.' It is chiefly as forming a lofty and conspicuous object that a single colossal column recommends itself as a triumphal monument; yet such general outline might be preserved without adhering to the precise shape and details derived from examples from any one of the orders. In this respect Trajan's pillar is not so great an architectural solecism as many of the numerous columns professing to be in imitation of, or 'after' it, because, owing to its shaft being entirely embossed with sculptures, which, as Dyer happily expresses it—

> '——————— wind aloft
> And lead through various toils up the rough steep
> Its hero to the skies'—

the ordinary column character is done away with, and a degree of variety and magnificence is produced which may be allowed to silence the objections of criticism. There certainly was something poetical in the idea of making the shaft which bore the emperor's statue record his conquests and military exploits; and the sculptures themselves are not only superior specimens of Roman art, but highly interesting and valuable as historical documents of costume. At the same time they serve to make evident how very ill the surface to which they are applied is calculated to display them; for, instead of being extended horizontally, this vast bas-relief is coiled spirally from the base to the summit, so that the figures on the upper part of the shaft can hardly be made out; nor can those on the lower one be viewed consecutively, without going round and round the column. This historical poem, as it has been called, addresses itself therefore more to the imagination than to actual inspection. Still the idea is magnificent, and the general effect of this column, as it stood originally in the centre of a regular area (Trajan's Forum), enclosed by colonnades, must have been equally grand and picturesque. Trajan's column and the surrounding forum were the work of Apollodorus of Damascus; and the former was completed A.D. 114, six years after its commencement. It is raised upon a pedestal of rather low proportions, which is also embellished with sculpture, as is likewise the base; therefore although it is usually described as being of the Tuscan order, its character is altogether different, it being that of extreme richness and decoration. It has a staircase within, and is constructed of white Luna, or what is now called Carrara marble. Semper, a German architect, who had lately an opportunity of minutely examining the upper part of the shaft, discovered traces of polychromy on the mouldings of the capital. Though not so lofty, the Trajan Column is very far superior to the Antonine. [Antonine.] There are engravings, by Piranesi, of both, on an exceedingly large scale, the plates showing the elevations of the columns, opening to an extent of 10 feet. The statue of St. Peter, which now stands on the Trajan Column, was erected by Domenico Fontana, in 1588, by order of Sixtus V. The following are the comparative heights of this and some other monumental columns, measured to the top of the abacus:—

Antonine Column, 136 feet.
Trajan Column, 115.
Monument, London, 174.
Napoleon, Place Vendôme, Paris, 116.
Pompey's Pillar (monolith), 98.
Alexander, St. Petersburg (monolith), 121.
Napoleon, Boulogne, 141.
York Column, London, 95.
Great Obelisk in front of St. Peter's, 132. [See Obelisk, p. 386, for the dimensions of others at Rome.]

TRAJANO'POLIS (Τραϊανόπολις, or Τραϊανούπολις), a town in Thrace, was most probably built by the emperor Trajan, who adorned it with beautiful buildings. Trajanopolis was situated on the river Hebrus, at a little distance north of the pass which is formed by this river through the range of Mount Rhodope, and about 40 miles from its mouth. According to the 'Itinerarium Antonini,' this town was situated between Bricires and Cypsela, 37 miles from Bricires, and 29 miles from Cypsela. Ptolemy mentions Trajanopolis (iii. 11). In the fourth century A.D. Trajanopolis was still a considerable town, and so it was in the time of Constantine Porphyrogenitus. Mannert thinks that this town was destroyed by the Turks in the fifteenth century, and he states that nobody has examined the ruins of it. Paul Lucas however discovered an antient aqueduct at a short distance from the present town of Trajanopoli. This modern town is situated on the banks of the Maritza, or Hebrus, on or very near the site of antient Trajanopolis. Trajanopoli, the see of a Greek archbishop, is a small town of no importance: in 1829 it was taken by the Russians on their march from Adrianople to Enos.

(Mannert, *Geographie der Griechen und Römer*, vii., p. 224.)

TRAJANO'POLIS, or SELI'NUS (Σελινοῦς), was the most western town of Cilicia. The emperor Trajanus having died at Selinus, this town was for some time called Trajanopolis. It was situated at the mouth of the river Selinus, on a steep rock, surrounded on three sides by the sea, and it was renowned for its commerce and navigation. According to Ptolemy, the district in which this town was situated had the name of Selentis. Its present name is Selenti, which must not be confounded with Zelina, a considerable town east of Selenti.

(Strabo, p. 682, Cas.; Dion Cassius, lxviii. 33; Livius, xxxiii. 20; Mannert, cited above, vi. 1, p. 85; Cellarius, *Notitiæ Orbis Antiqui*, ii., p. 196; Beaufort's *Karamania*.)

TRAJANO'POLIS, a town in Mysia, between Antandrus and Adramyttium, according to the maps in the editions of Ptolemy, who mentions it among the towns of Mysia, but he puts it in 50° E. long. and in 40° 40′ N. lat. The longitude is apparently an error, because this point would be situated a little north of Thessalonica in Thrace, and not in Asia. The error being manifest, almost all editions of Ptolemy have adopted 56° instead of 50°; but in the edition of Joh. Noviomagus, Coloniae, 1540, 8vo. (p. 214), there is 50°: Mercator has 56°. Some geographers have made two towns of it, one in Mysia, and the other in Thrace. Cellarius thinks that Trajanopolis was not situated in Mysia, but farther east in Phrygia Major (ii., p. 40); and Mannert (vi., 2, p. 542) thinks that Trajanopolis is only another name of Melitopolis, in the mountains of Mysia, east of 56° E. long.

TRAJA'NUS, MA'RCUS U'LPIUS NE'RVA, was most probably born in 53 A.D., at Italica, the present Alcalà del Rio, on the Guadalquivir, not far from Seville in Spain. He was the son of one Trajan, who was descended from an old Spanish or Iberian family, and who is said to have been a consul (Eutropius, viii., c. 2); but his name is not found in the Fasti Consulares. Eutropius gives to Ulpius Trajanus the surname of 'Crinitus,' perhaps because he wore his hair long, as did his countrymen the Iberians. Trajan the elder having obtained a command in Asia Minor, went there, accompanied by his son, who distinguished himself at an early age in the wars against the Parthians and the Jews. He became consul in A.D. 91, together with Acilius Glabrio. After he had discharged his function he went to Spain, and he afterwards commanded the legions on the Lower Rhine. His military talents and his amiable character made him popular with the troops; and though we know very little about his early life, we must suppose that his merits were great. This we may conclude from the circumstance that the emperor Nerva, an old man without issue, adopted him in A.D. 97, and chose him for his successor, although there were several relations of Nerva who had perhaps more claims to the throne than Trajan. But, says Dion Cassius (lxviii., c. 4), Nerva was exclusively led in his choice by his care for the welfare of the empire; and he considered Trajan's Iberian origin as a matter of indifference. Yet Trajan's nomination as Cæsar was a new thing in Roman history, the imperial throne having hitherto been exclusively occupied by members of the old Roman aristocracy, so that Trajan was the first emperor who was born beyond the limits of Italy.

Trajan received the news of his nomination in Cologne, and three months later (Aurelius Victor, *Epitome*, c. 12) the death of Nerva, which took place on the 27th of January, 98, made him master of the Roman empire. On his arrival at Rome the people received him with great demonstrations of joy, and Trajan soon proved that he deserved his high station. He appointed distinguished and honest men as public functionaries; he curbed the turbulent body of the Praetorians; he issued an edict against false accusers, and he banished those who were convicted of this crime to the barren islands of the Mediterranean. Corn being dear in Rome, he allowed its entrance duty-free, and he thus won the hearts of the people, while those whom he honoured with his intercourse were delighted by his affability. Yet the emperor never forgot his dignity. His virtues and eminent qualities became conspicuous in the first years of his reign, as we may see from the panegyric of Trajan, which Pliny the younger read in the senate as early as 100, after he had been made consul. In 103 Pliny, who was a personal friend of the emperor, was appointed proconsul of Bithynia and Pontus; and having inquired into the state of the Christians, he recommended them to the emperor, and thus mitigated the persecutions to which they had hitherto been exposed by Pliny himself. The letters that passed between Pliny and Trajan are the best sources with regard to the private character of this emperor.

As early as 100 Trajan was engaged in a war with Decebalus, king of the Dacians; at the head of a numerous army Trajan crossed the Danube, defeated the enemy, and in 101 took their capital, Zermizegethusa (Dion Cassius, lxviii., c. 9), which was most probably situated on the site of the present village of Varhely, not far from the pass of the 'Iron Porte,' in Transylvania. In 102 Decebalus was compelled to purchase peace by the cession of a part of his territory; and on his return to Rome Trajan celebrated his first triumph, and was saluted with the name Dacicus. Lucius Quintus and Hadrianus, afterwards emperor, distinguished themselves in this war. Annoyed by his dependence on Rome, Decebalus violated the peace as early as 104, and Trajan hastened to the Danube, resolved to finish the war by the conquest of Dacia. He ordered a bridge to be constructed over the Danube, which was the largest work of this kind mentioned by the antients. According to Dion Cassius it consisted of twenty piers, 150 feet high, 60 wide, and 170 feet apart; the piers were united by wooden arches. (Dion Cass., lxviii., c. 13, ed. Reimar, and the note.) The whole length of it has been calculated at 4770 Roman feet. If the statement of Dion Cassius is true, this bridge seems not only to have served for the passage of the river, but the immense height of the pillars, of which scarcely more than seventy feet can have been under water, leads to the supposition that it was at the same time a strong fortification destined to command the navigation. At a height of eighty feet above the water, soldiers were protected against the missiles of the Dacian ships, while the fleet of the enemy in passing that bridge ran the risk of destruction. This bridge was either at Szernecz in Hungary, or five leagues above the junction of the Alt with the Danube, in Wallachia, not far from Nicopolis, where ruins of the Roman colonies of Romula and Castra Nova, and a Roman road, which is pretty well preserved, still exist. The war proved fatal to Decebalus. Defeated wherever he encountered the Romans, he killed himself in despair (105); and in 106 all Dacia was conquered and made a Roman province by Trajan, who sent there numerous colonists. [WALLACHIA.] Trajan returned to Rome in the same year, and celebrated his second Dacian triumph. In memory of his victories over the Dacians a column was erected, in 114, by the architect Apollodorus, on the Forum Trajani, which, having been preserved from ruin, is still admired as one of the finest remnants of antient art. The column was 144 Roman feet high, according to Eutropius (viii., c. 2), and on the base of it is the following inscription:—

SENATUS . POPULUSQUE . ROMANUS
IMP . CAESARI . DIVI . NERVÆ . F . NERVÆ
TRAIANO . AUG . GERM . DACICO . PONTIF .
MAXIMO . TRIB . POT . XVII . IMP . VI . COS . VI . P . P
AD . DECLARANDUM . QUANTAE . ALTITUDINIS .
MONS . ET . LOCUS . TANTIS . OPERIBUS
SIT . EGESTUS.

Another column, which is likewise extant, was erected in honour of Trajan by the inhabitants of Beneventum after his victories over the Parthians.

After the conquest of Dacia, eight years of peace elapsed, which Trajan employed in a careful administration, and in adorning Rome with beautiful buildings; he also founded a library, the Bibliotheca Ulpia, and an institution for the education of poor children of Italian parents. (Fr. A. Wolf, *Von einer milden Stiftung Trajan's*, Berlin, 1808, 4to.) In 114 Trajan left Rome to lead his armies against the Parthians.

In the Asiatic part of the empire peace had already several times been disturbed, principally by the Arabs, who however were subdued by Cornelius Palma, the proconsul of Syria, who, in 105, conquered Arabia Petræa, and made it a Roman province. Some years later Cosrhoes, or Khosrew, king of the Parthians, deprived Exedares, king of Armenia, of his dominions, and created his brother Parthamaspes, or Parthamasiris, king of Armenia. The Romans having always been anxious to maintain their influence in Armenia—the independence, or rather dependence of this country on Rome was necessary for the security of the East—Trajan declared war against Khosrew. The Parthians were defeated, and in one campaign Trajan conquered Mesopotamia and delivered Armenia. He took up his winter-quarters at Antioch, relieved the Syrians, who were suffering from the consequences of a violent earthquake, and in the following year, 115, opened a new campaign. He crossed the Tigris, in the province of Adiabene, and the Parthians having again been defeated, he took the towns of Nisibis, Edessa, Ctesiphon, and Seleucia; Babylonia, Assyria, Armenia, and Mesopotamia became Roman provinces; a rebellion of the Jews in Egypt and Cyrenaica was quelled; Khosrew was deposed, and his brother Parthamasiris was put by Trajan on the throne of Parthia.

TRAIANO AVG GER DAC P M TR P COS V P
IMP CAES NER
OPTIMO
S P Q R
S C

Coin of Trajan, with Reverse.
British Museum. Actual Size. Bronze.

Reverse of Coin of Trajan.
British Museum. Actual Size. Bronze.

After the conquest of these extensive provinces Trajan sailed with his fleet on the Tigris to the Persian Gulf, and took up his winter-quarters in the town of Spasinus. When he had reached the sea, the example of Alexander suggested to him the idea of conquering India, but remembering his advanced age, he renounced that scheme. (Dion Cassius, lxviii., c. 29.) In 117 Trajan made an incursion into Arabia, and ordered a fleet to be kept on the Red Sea. Suffering from dropsy, he set out for Rome, but he died on his way at Selinus, a town in Cilicia [TRAJANOPOLIS], in the month of August, 117, at the age of sixty-three years nine months and four days, according to Eutropius (viii., c. 2).

Trajan was one of the greatest emperors of Rome. He is said to have been addicted to women and wine; but his public character was without reproach, except his passion for warfare and conquest. However he undertook no war for frivolous motives. He deserved the title of 'Optimus,' which the senate conferred on him. The memory of his name lasted for centuries, and two hundred years later the senators used to receive the emperors with the acclamation, 'Be happier than Augustus, and better than Trajan!'

The body of Trajan was transported to Rome, where it was deposited under the Columna Trajani. His successor was Hadrian.

(Aurelius Victor, *De Cæsaribus*, c. 13; *Epitome*, c. 13; Sextus Rufus, *Breviarium*, c. 8, 14, 20; H. Francke, *Zur Geschichte Trajans und seiner Zeitgenossen*, 1837, is a very valuable book.)

TRAJECTORY, the technical name which was formerly given to a curve, that is, to a curve required to be found by means of given conditions; most frequently used for the required path of a particle acted on by given forces. The term is now seldom used.

TRALEE, the assize-town of the county of Kerry, in the province of Munster in Ireland, 159 miles in a direct line south-west of Dublin, or 192 miles by the mail-road through Naas, Maryborough, Roscrea, Nenagh, Limerick, Rathkeale, Tarbert, and Listowel; 73 miles south-west of Limerick, and 74 miles west-north-west of Cork, through Macroom and Killarney: in 52° 15′ N. lat. and 9° 38′ W. long.

Tralee derives its name ('Traigh-lee,' 'the strand or shore of the Lee') from its position near the outfall of the little river Lee into the shallow and unsafe bay of Tralee. There was antiently a Dominican friary, under the invocation of the Holy Cross, founded (A.D. 1213) by John Fitz-Thomas, one of the great Geraldine family. The knights of St. John of Jerusalem had also a commandery in this neighbourhood. In the Irish wars of Queen Elizabeth a body of Irish was routed at Tralee (A.D. 1600) with great slaughter by Sir Charles Wilmot. The earl of Desmond had a castle here, which having come, on the forfeiture of the earl, into the hands of Sir Edward Denny, served as a place of refuge for the English families resident in and about the town when Tralee was entered by the insurgents in the great rebellion of 1641. The castle held out for six months, but was at last obliged to surrender. The town was soon after burned, to prevent its falling into the hands of Lord Inchiquin. It was again burned (A.D. 1691) on the approach of King William's army.

Tralee is in the barony of Trughenackmy: the parish is about four miles in length and one and a half in breadth, and has an area of 4391 acres, statute measure: the population in 1831 was as follows:—

	Houses.					
	Inhabited.	Uninhabited.	Building.	Total.	Families.	Persons.
Town and borough	1218	118	88	1424	1801	9,568
Rest of parish	242	..	..	242	258	1,453
	1460	118	88	1666	2059	11,021

The borough comprehends not only the town, but a considerable rural district around it: it does not however comprehend the whole parish. The population of the borough, in 1821, was only 7547; so that the increase in ten years (1821-31) was 2021; and the population has considerably increased since 1831.

The town is irregularly laid out on a low site, north of the river Lee, and at some little distance from the bay; it is liable from its situation to be flooded when there are spring-tides in the bay and the stream of the Lee is swollen. The streets are repaired by county presentment, and are partially paved and flagged, but not lighted; neither is there any nightly watch. An attempt to introduce the provisions of the new paving and lighting act (9 Geo. IV., c. 82) was resisted by the inhabitants. The sewers in the town are bad, and the streets are very dirty. There is no regular market-place, and the business of the market is conducted in the streets. Some of the streets are lined with respectable dwelling-houses (several of them of a superior description) and good shops; and the town has undergone great improvement within the last few years. The church is a large and handsome building, with a square tower crowned with pinnacles: the congregation averages 700 persons, and is increasing. There is a large and handsome Roman Catholic chapel (attended by 3000 persons), a small Methodist meeting-house, and another small one for Independents. Detached from the town, half a mile to the south-east, are the county gaol and a barrack; they are both substantial buildings; the gaol, built on the radiating principle, is capable of accommodating more than 200 prisoners; the barrack is capable of accommodating nearly 500 men, and has an hospital for 30 patients. A considerable brewery and a distillery are near the gaol. The county court-house, a handsome building of modern erection, is in the town; and in the same street as the court-house is the county club and news-room. There are an extensive brewery, besides that already mentioned, and a smaller brewery, both in the town.

The trade of Tralee is considerable, and it has been for some years rapidly progressive. In 1831, 991 persons were employed in the town and borough in retail trade and handicraft; and there were 214 capitalists, bankers, professional, and other educated men. There are two weekly markets, well supplied, and five yearly fairs. There are three banking establishments. The town is well supplied with fish, and on reasonable terms. Tralee is a port, but vessels have had to take in and discharge their cargoes at Blennerville, on the shore of the bay, a mile and a quarter distant: a ship-canal is in progress, perhaps finished by this time, by which vessels of 300 tons will be enabled to come up to the town, at the west end of which a large basin has been constructed. The port is visited yearly (taking the average of the seven years from 1827 to 1833) by about seven vessels (having a total of 1500 to 1600 tons) from foreign parts; in the same years nearly forty coasters (about 3000 tons) from Great Britain entered inwards, and about twenty-five coasters (800 to 1000 tons) from other ports in Ireland; while about fifty-five coasters (about 4000 tons) cleared out for Great Britain, and about fifteen or sixteen coasters (500 to 700 tons) for other ports in Ireland. The trade with Great Britain, especially the export trade, was steadily increasing through that interval; but the trade with other ports of Ireland was decreasing. The chief foreign goods imported were timber, deals, and staves; the chief article of import from Great Britain was coals; and the chief exports were wheat and oats, both rapidly increasing; barley, also increasing; and butter, which was diminishing.

The corporation of Tralee (consisting of a provost, twelve free burgesses, and other officers) was created by charter of James I. It never had any property except the tolls on the Tuesday market and on one of the fairs: it has been abolished by the late act (3 & 4 Vict., c. 108) for regulating the Irish municipal corporations. Before the abolition there was a provost's court, which was a court of record for all personal actions not exceeding the sum of five marks. Petty sessions were held by the provost and some of the county magistrates twice a week. There was no borough gaol. The assizes for the county of Kerry are held here; and the assistant-barrister for the county sits at quarter-sessions and for the trial of civil bills four times in the year. Some of the county police are stationed in the town.

Tralee returns one member to parliament. By the Irish Boundary Act (2 & 3 Wm. IV., c. 89), a boundary was adopted for parliamentary purposes, more restricted than the existing municipal boundary, but comprehending all the town, and allowing space for its extension. The number of electors on the register in 1839-40 was 296, namely 285 ten-pound householders and 11 freemen.

Tralee is a rectory in the diocese of Ardfert, and in the province of Cashel, now united to that of Dublin: the gross yearly value of the living is estimated at 454*l.* 7*s.* 7½*d.*, the net value at 377*l.* 16*s.*; there is a glebe-house fit for residence. In the Roman Catholic division the parish is united with the greater portion of three adjacent parishes. There is a nunnery of the order of the Presentation.

There were in the year 1835 nine day-schools in the parish of Tralee: one of these, a free-school, with an average attendance of 50 children, was under the superintendence of the rector, and was supported by a grant from Erasmus Smith's fund, and by contributions from the clergy of the establishment; a second free-school was under the same superintendence; two others, free-schools, with an average attendance of 500 children, were under the superintendence of the Roman Catholic clergy, and were partly taught by the nuns of the Presentation; the other five schools, with an average attendance of 35 children each, were respectable schools, kept by ladies, and supported by the payments of the pupils.

The county fever-hospital, the county infirmary, with a dispensary attached, are at Tralee; and there are two asylums for the poor, a neat row of almshouses, a temporary asylum for lunatics before sending them to the district asylum at Limerick, and a prosperous savings' bank.

Races are held near the town, and a yearly regatta in the bay. There is a chalybeate spring about three miles west of the town, it is not in Tralee parish, on the northern shore of the bay, round whicha small watering-place has risen up, called 'the Spa of Tralee,' or more concisely 'Spa.' There is an excellent strand for bathing. There are several gentlemen's seats round Tralee. Good limestone for building is quarried near the town.

(*Reports of Commissioners*, and other *Parliamentary Papers;* Lewis's and Carlisle's *Topographical Dictionaries; Dublin Almanack.*)

TRAM-ROAD, a road prepared for the easy transit of trams or waggons, by the insertion, in its surface, of smooth beams of wood, blocks of stone, or plates of iron, as wheel-tracks. It is therefore a kind of railway, adapted for the passage of vehicles with wheels of the ordinary form. Of the early kinds of railway which bear the characteristics, and frequently also the name, of tram-roads, an account is given under RAILWAYS, vol. xix., pp. 245, 246; and of the mode of constructing tram-ways in ordinary roads, and their advantages, a notice will be found under ROAD, vol. xx., pp. 33, 34.

TRAMMELS, the name of the ELLIPTIC COMPASSES, described in that article, in which a bar carrying a pencil is guided by two pins which move in grooves.

TRA'NI, a considerable town of the kingdom of Naples, situated on the coast of Apulia in the province of Terra di Bari, is an archbishop's see, whose archbishop is also bishop in partibus of Nazareth. The Gran Corte Civile, or court of appeal for civil suits, of the two provinces of Terra di Bari and Terra d'Otranto, and the Gran Corte Criminale of the province of Bari, hold their sittings at Trani. The town is well built: it has a castle, which was built by the emperor Frederic II.; a handsome cathedral with a lofty tower, and several other churches and convents; a harbour for small vessels; and about 15,000 inhabitants, who carry on a considerable trade in agricultural produce, especially oil and corn. Trani is 8 miles S.E. of Barletta, 26 miles N.W. of Bari, and 120 miles E.N.E. of Naples.

(Neigebaur, *Gemälde Italiens;* Serristori, *Statistica dell' Italia.*)

TRANQUEBAR. [HINDUSTAN, p. 208.]

TRANSACTIONS, PHILOSOPHICAL, are the volumes containing the several papers relating to the sciences, which, after having been read at the meetings of the Royal Society of London, have been thought worthy of being made public at its expense. In the article ROYAL SOCIETY there has been given an account of the publication of the first portions of the work, and of the number of volumes which have appeared, from the time of its commencement in 1665, to the year 1841.

The papers are inserted in the volumes according as they were presented, and consequently they are destitute of any arrangement with respect to the nature of the subjects to which they relate; but in Dr. Thomson's 'History of the Society,' brief notices of the most important papers will be found, under the particular heads to which those papers belong, and that work must therefore be considered as a valuable guide for those who would trace the progress of scientific discovery in this country during nearly 180 years, which have elapsed since the formation of the Society: it is to be regretted however that the work extends only to the end of the eighteenth century. Dr. Thomson has arranged the subjects of the papers in the 'Transactions,' under the following divisions:—

Natural History,
Mathematics,
Mechanical Philosophy,
Chemistry,

and to these are added several miscellaneous articles.

Under the first of these divisions are placed Botany, Zoology, Mineralogy, Geography, and Topography: and the number of papers on the first of these subjects amounts to about one hundred; it is observed however, that few of these were presented by members of the Society and that since the formation of the Linnean Society, in 1788, none have been received in the 'Transactions.' Sir Hans Sloane, who was elected in 1684, was the principal contributor, and his botanical papers are still of considerable value. The physiology of plants was first investigated by members of the Royal Society, but the discoveries which have been made during the present century have very much diminished the importance of the earlier papers on this branch of Natural History. The most curious are those of Dr. Grew (1670), on the anatomy of plants; of Mr. Barrel (1727), on the growth of the misseltoe; of Dr. Smith (1788), on the irritability of plants; and the several papers by Mr. Knight which were read in 1799 and in subsequent years. Forty papers relate to agriculture, but they are of early dates; and the first is a review (1669) of Evelyn's 'Sylva and Pomona.'

In the 'Transactions' are numerous detached papers on zoology, and these contain descriptions of several species of mammalia, birds, amphibia, fish, zoophytes, &c. Short notices only of anatomical discoveries occur, and the earliest is a paper (1691), by Clopton Havers, on the structure and growth of bones: the 'Transactions' are, however, enriched by several papers on comparative anatomy. Of Physiology, or the properties and functions of living bodies, the number of papers is considerable, and they are classed by Dr. Thomson under the following subdivisions:—Circulation of the Blood, Respiration, the Action of the Skin, the Nervous System, Vision, Organs of Motion and Nourishment. The second, third, and fifth volumes contain papers by Mr. Boyle on respiration; and among the later volumes will be found those of Dr Currie (1792), and Mr. Brodie (1811), on animal heat there are also two curious papers on the temperature which the human body is capable of bearing; and recently (1840), a valuable paper by Sir Charles Bell on the Nervous System.

The Medical and Surgical papers are numerous; and though they are on miscellaneous subjects, they constitute a valuable repository of information on those branches of knowledge; among them are some remarkable cases of persons being burnt to death without visible cause, and an account of the cases of death from the gaol-fever in 1759; there are also several papers relating to inoculation for the small-pox, of which the first is in the volume for 1714; and a paper by Mr. Cheselden containing an account of the operation performed on the eyes of a boy who was born blind.

The 'Transactions' contain few notices relating to Mineralogy: among the earlier papers is one (1671) on the formation of cloth and paper from amianthus, and another (1731) on the first discovery of diamonds in Brazil.

Under the head of Geology may be placed some important papers concerning the rocks which constitute the crust of the earth; and there are several on petrifactions, on shells and zoophytes, and on fossil bones. Among them also is a paper (1711) on the origin of peat, by the earl of Cromartie, and on mosses (1772), by Dr. Walker. Forty-five papers have been published concerning the earthquake at Lisbon, besides several on volcanoes, burning al-pits, and on the temperature of hot-springs. Mr. Hopkins's 'Researches on Physical Geology' appear in the olume for 1840. It is remarkable that most of the wild heories which have been formed to explain the cause of he Noachian deluge and of the present state of the earth re to be found in the volumes of the 'Transactions.'

Among the papers relating to Geography and Topo-raphy is one by Mr. Murdoch (1758), describing the method of representing part of the earth's surface on that f a cone; but the most important papers belonging to hese subjects are those which contain Dr. Maskelyne's bservations (1775) on the attraction of mountains, and he proceedings relating to the trigonometrical survey of he British Isles by Generals Roy and Mudge and Colonel olby.

The second great division is that of Mathematics, and n this important subject the papers are numerous. Among those which relate to the antient Geometry are he papers of Dr. Simson (1723), and of Mr. Brougham 1798), on Porisms; a problem by Dr. Pemberton (1763), oncerning loci, and a paper by Dr. Horsley (1772), on he invention of Eratosthenes for determining prime umbers. There are nine papers on the origin of the ine digits; in one of which, by Mr. Barlow (1741), it is hown, from a date in the parish church of Romney, that he Arabic numerals must have been known in England bout the year 1000. Of the rest, the most important are he logarithmotechnica of Mercator; the papers of Dr. Halley, Mr Cotes, and Mr. Hellins, which relate also to ogarithms; the papers on the nature of equations, on ries, and on annuities, also those which relate to the onic sections and to the quadrature of curves. In the ater volumes will be found the important papers which ave been contributed by the eminent mathematicians of he present day.

Under the third great division, which is that of Mechani-al Philosophy, are classed Astronomy, Optics, Dynamics, Mechanics, Hydrodynamics, Acoustics, Navigation, Electricity, and Magnetism; and among the papers relating to stronomy are those of Dr. Halley (1691, 1716), on the onjunctions of the inferior planets, and on the transits of Venus; those of Dr. Bradley (1723, 1747) describing his discovery of aberration and nutation; besides the accounts of Sir William Herschel's astronomical observations. The rincipal optical papers are those which contain Newton's xperiments on light (1672); Dr. Halley's paper (1693) ontaining formulæ for finding the foci of optical glasses; Mr. Dollond's account (1758) of his discovery of the achromatic telescope; and the papers on the recent discovery of the polarity of light. To dynamics belong the papers ontaining the mathematical theory of the collision of bodies, by Dr. Wallis, Sir C. Wren, and Mr. Huygens 1668-9); Mr. Smeaton's paper (1776) on the quantity of mechanical power necessary for giving different degrees of velocity to heavy bodies; with those of Mr. Landen 1777) and Mr. Vince (1780) on the rotatory motion of bodies. There are comparatively few papers on the subject of mechanics: among them are those of Huygens and Hooke (1675) on watches: a valuable paper (1785) by Mr. Vince on friction; and one by Mr. Hodgkinson (1840) on the strength of cast-iron pillars. With respect to hydrodynamics and hydraulics, the most important are those of Mr. Canton (1762-4) on the compressibility and elasticity of fluids; and two by Mr. Atwood (1796-8) on the stability of ships. Mr. Smeaton has a valuable paper (1759) on the power of wind and water to turn machines; and Mr. Vince (1798) one on the resistance to bodies moving in fluids. There are several papers on the suspension of water in capillary tubes; and there is one by Mr. Beighton 1731), giving an account of the water-works at London. The papers on pneumatics consist chiefly of those which were contributed by Dr. Halley (1686), Sir George Shuckburgh, and General Roy (1777), on the measurement of heights by the barometer; with those of Greaves, Halley, Robins, Hutton, and Count Rumford, on the force of fired gunpowder. The principal papers relating to acoustics are, one by Dr. Denham (1768) on the velocity of sound; and one by Dr. Young (1800) on sound and light. Those which come under the head of navigation consist almost wholly of descriptions relating to the phenomena of tides.

Almost every discovery in the science of electricity has been made by members of the Royal Society, and the number of papers relating to this subject is considerable. Among them are accounts of the experiments made by the earliest electricians, Hauksbee, Gray, Dufay, and Desaguliers. Dr. Watson has a paper (1748) on the distances to which shocks may be conveyed by conductors, and another (1751) in which an account is given of Franklin's 'Treatise on Electricity.' There is a paper by the Abbé Nollet (1748) on the effect produced by electricity on water flowing through capillary tubes; one by Mr. Wilson (1759) on the heated tourmalin; and another by the same (1773) on the efficacy of blunt conductors: there are also several papers by Dr. Priestley on electrical subjects; Mr. Cavendish's theory of electricity (1771): Volta's account (1800) of the galvanic pile; and Sir Humphry Davy's paper containing his great discovery concerning the agency of galvanism in decomposing compound substances; besides the highly valuable papers by Mr. Faraday concerning his experimental researches in electricity. Among the papers on magnetism are that of Dr. Brook Taylor (1715) on the law of magnetic attraction; the hypothesis of Halley concerning the cause of the dip and variation of the needle; and Lt.-Col. Sabine's recent contributions on terrestrial magnetism.

The Transactions are rich in papers on Chemistry, which however are of a miscellaneous nature: among the more important are, the paper of Mr. Brand (1736) on hydrogen gas; that which states the experiments of Mr. Cavendish (1783) to determine the components of atmospherical air. There is a paper by Dr. Henry of Manchester (1797) on the expansion of carburetted hydrogen gas by electricity; and one by Mr. Kirwan (1786), containing an account of his experiments on sulphuretted hydrogen gas.

There are many papers on the subject of Meteorology, but most of them are merely diaries of the weather: among them however is a paper by Dr. Heberden (1765) on the rate at which temperatures diminish in the atmosphere as the distances from the surface of the earth increase.

Among the papers which Dr. Thomson ranks as miscellaneous are the few which relate to Antiquities: these contain accounts of the ruins of Palmyra (1695), Pompey's pillar (1767), the catacombs of Rome and Naples (1760); and there are several papers on the discoveries made in Herculaneum.

TRANSCENDENTAL, a mathematical term of description, the meaning of which is not very uniform. When any particular formula is incapable of being expressed by any particular range of algebraical symbols, it is, with respect to those symbols, transcendental, that is, it transcends or climbs beyond the power of these symbols. The word was perhaps first used by Leibnitz ('Leipzig Acts,' 1686), who says, 'placet hoc loco, ut magis profutura dicamus, *fontem aperire transcendentium quantitatum*, cur nimirum quaedam problemata neque sint plana, neque solida, neque sursolida, aut ullius certigradus, sed omnem aequationem algebraicam transcendant.' Here then is the first meaning of the word; a transcendental problem is one the equation of which is infinitely high, or contains an infinite series of powers of an unknown quantity, so that its highest degree transcends every degree.

To form an idea of what is now most commonly meant by transcendental, it will be desirable to recapitulate the steps by which algebra has arrived at its present state of expression; or rather, mathematical analysis, as those would say who do not like to call the differential calculus by the name of algebra.

And first we have the state which preceded the time of Vieta, in which formulæ were mostly described in words, and the adoption of arbitrary symbols of quantity was only of casual occurrence.

Next, we have the introduction of arbitrary symbols of quantity by Vieta, but not to the extent of using arbitrary numbers of multiplications, or algebraical exponents. Here what we now call a^n was transcendental; Vieta could have described a^6 by a cubo-cubum, or a^7 by a quadrato-quadrato-cubum, but a^n had neither name nor symbol.

Thirdly, we have the stage which began with Harriot and Descartes, and which brought ordinary algebra into substantially its present form. During these periods however geometry and arithmetic, without help from algebra, had brought into use sines, cosines, &c., and logarithms, which were then properly transcendental. The words which described a particular mode of drawing lines in a circle, or the result of many interpositions of geometrical means between two given numbers, did not place those lines or means among the objects of algebra, and gave no clue to any algebraical properties.

Fourthly, we have the short but interesting period in which, before the formal invention of fluxions or the differential calculus, infinite series began to be employed, and the transcendentals last alluded to ceased to be absolutely incapable of expression. This was the state in which Leibnitz found the science when he first proposed to distinguish between algebraical and transcendental problems.

Fifthly, we have the period succeeding the invention of the differential calculus, in which the areas and lengths &c. of curves could be expressed, whether they could be reduced into older language or not, by the new signs for fluents or integrals.

Sixthly, we have an alteration which it might have been supposed should have come long before, namely, the expression of the old transcendentals as recognised functions, and the writing of them accordingly, as $\log x$, $\sin x$, $\cos x$, &c. Strange as it may appear, this was never formally and steadily done till the time of Euler. And it is only in our own day that the system has been completed by the recognition of the number whose logarithm is x, the angle whose sign is x, &c. as functions of x, and the adoption of the appropriate symbols $\log^{-1} x$, $\sin^{-1} x$, &c.

Seventhly, a most important addition has been coming into use in the present century, namely, the employment of definite integrals as modes of expression, not merely of functions of the variable of integration, but of other quantities which only enter as constants, or which, if they vary, vary independently of the variable used in integration. So powerful is this mode of expression, that it may almost be suspected to be final: and the word transcendental is rapidly acquiring a new meaning. We predict that it will settle into the following: a transcendental result will be one which is incapable of expression except by a definite integral, or by an infinite series which cannot be otherwise expressed than by a definite integral.

In the meanwhile there are two senses in which the word is used. The first is that just explained; the second has reference to the old distinction of algebraical and transcendental. A function of x is algebraical when it is finite in form, and x is never seen, nor any function of it, in an exponent, nor under the symbols of a sine, cosine, &c., or a logarithm. No operation then enters with x unless it be one of the four great operations of arithmetic, or else involution or evolution with a definite exponent. Thus in this sense of the word, $\log x$ and $\sin x$ are both transcendentals. But in the modern sense in which transcendental is not opposed to algebraical, but to that which is expressible by ordinary means, $\log x$ and $\sin x$ are not transcendental, being among the most common of the present modes of expression, and being, in fact, connected with algebra in a way which, had it been understood when these symbols were first used, would probably have always saved them from the distinctive term.

The roots of equations of the fifth and higher degrees are, properly speaking, transcendental: there is no mode of expression except by infinite series. And, generally speaking, and with the exception of a few cases in which modes of expression have been invented and studied, INVERSE functions are transcendental. And a result of such inversions, even though, from our ignorance of its real properties, it may be expressible by ordinary means, is transcendental as long as that ignorance lasts. And it is useful to observe that forms of the most different kind may be connected together by such a relation as this, that both are cases contained under the same transcendental.

To exhibit the arrival of one of these transcendentals of inversion, as they might be called, let us take the equation $\phi x . \phi' x = \phi(\phi x)$, where $\phi' x$ means the differential coefficient of ϕx. A large class of solutions may be obtained as follows:—The equation $y \log y = \mathrm{C}$ has an infinite number of roots, two at most being real, and all the rest of the form $\alpha + \beta\sqrt{-1}$. Let a, b, c, &c. be any of these roots, and let ψx be a function of x formed as follows:—

$$\psi x = \mathrm{A}a^x + \mathrm{B}b^x + \ldots.$$

where one, two, or any number of roots may be taken at pleasure: and A, B, &c. are any quantities independent of x. Let $\psi^{-1} x$ be the inverse function of ψx, so that $\psi(\psi^{-1} x)$ is x; then $\psi(\psi^{-1} x - 1)$ is a solution of the original equation, or $\phi x = \psi(\psi^{-1} x - 1)$ gives $\phi x . \phi' x = \phi(\phi x)$. Now $\psi^{-1} x$ is, when more than one root is used, inexpressible except by infinite series: that is, not merely inexpressible in common algebraical terms, but even with the assistance of logarithms and trigonometrical functions. Nevertheless, as particular cases of this solution, both [illegible] and $\sqrt{(b^2 - x^2)}$ are found.

As science advances, quantities which are now called transcendental will lose the name, and be received among the ordinary modes of expression of analysis. One of the first of these will be the well-known function of n, which is generally designated by Γn, and is sometimes called the *gamma*-function, sometimes the factorial function. Its expression is $\int \varepsilon^{-x} x^{n-1} dx$ taken from $x = 0$ to $x = \infty$ and when n is an integer it is simply $1 \times 2 \times 3 \times \ldots . \times n$. But when n is a fraction it can only be calculated by series. Nevertheless, as tables are now formed of its values, and as many properties and consequences of it are known, it stands in as favourable a position for use as ordinary logarithms at the end of the seventeenth century.

TRANSCENDENTAL, a technical term in philosophy, derived from the Latin *transcendere*, to go beyond a certain boundary. In philosophy transcendental signifies anything which lies beyond the bounds of our experience, or which does not come within the reach of our senses. It is thus opposed to empirical, which may be applied to all things which lie within our experience. All philosophy therefore which carries its investigations beyond the sphere of things that fall under our senses is transcendental, and the term is thus synonymous with metaphysical. Transcendental philosophy may begin with experience, and thence proceed beyond it; or it may start from ideas *à priori* which are in our mind: in the latter case philosophy is purely transcendental; while in the former it is of a mixed character. [METAPHYSICS.]

TRANSFORMATION, a general term of mathematics, indicating a change made in the object of a problem or the shape of a formula, in such manner that the original problem or formula is more easily solved, calculated, or used after the transformation. Thus it frequently happens that the solution of an equation is facilitated by reducing it to another equation having roots which bear simply a relation to the roots of the former: as an instance, we may refer to the solution of the cubic equation in the article IRREDUCIBLE CASE.

All the process of algebra consists in transformation, from and after the point at which the problem to be solved is reduced to an equation: so that to write on this subject in detail would require an article on algebra. A few remarks on the leading points which present themselves in transformations are all we can here undertake to give.

It frequently happens that transformation points out the nature of a consequence in a manner by which the direct reasoning of algebra is strongly confirmed and illustrated. For instance, when we assert that a quantity has two square roots, one positive and one negative, our assertion is easily verified in its positive part: but it does not follow by the same reasoning that a quantity has *only* two square roots. We may say that $x^2 = 4$ is satisfied by $x = 2$, or $x = -2$ because $2 \times 2 = 4$, and $-2 \times -2 = 4$; but how are we to say that there are no other values which satisfy this equation? When we transform the equation $x^2 = 4$ into $(x-2)(x+2) = 0$, with which it is identical, we then see that this product can only vanish when $x - 2$ or $x + 2$ vanishes; that is, when x is $+2$ or -2.

Transformations frequently leave a point unsettled which can only be determined by a subsequent species of experimental test; or, lest the word experimental as applied to mathematical reasoning should give alarm, by a process of detection which is to choose between alternatives which the process of transformation leaves undecided. This frequently happens when the nature of the transformation is ascertained by means not of the expression to be transformed, but of one of its particular properties. For instance, when we expand a nto a series of powers of x, supposing we proceed upon the property $a^x \times a^y = a^{x+y}$, we find that there is no series fit to fulfil this condition except

$$1 + \mathrm{A}x + \frac{\mathrm{A}^2x^2}{2} + \frac{\mathrm{A}^3x^3}{2.3} + \ldots.$$

but we also find that this series is equally fit to fulfil the condition, whatever may be the value of A. So far then our transformation is effected: we see that one among the series formed by giving values to A must be the series we want, if there be any such series. If we make $x = 1$, we then immediately detect the condition which is to give the value of A, namely, that A must be so taken as to make

$$a = 1 + \mathrm{A} + \frac{\mathrm{A}^2}{2} + \frac{\mathrm{A}^3}{2.3} + \ldots.$$

This brings us to the mention of a defect of reasoning which has frequently vitiated mathematical works, namely, the assumption of the species of a transformation, and the supposition that only the character of the details remains to be settled, or the individual of the species to be picked out. In the preceding case, for example, it is often stated as follows:—'Required the expansion of a^x in a series of powers of x.' The form of the series is then assumed, say $p + qx + rx^2 + \ldots$, and by the use of the property above alluded to, it is found that the series must be of the form $1 + \mathrm{A}x + \frac{1}{2}\mathrm{A}^2x^2 + \ldots$. But, as noticed in SYNTHESIS, all that is here proved is, that if a^x be capable of expansion in integer powers of x, the expansion must be of the form $1 + \mathrm{A}x + \ldots$. It is true that, looking at what we see in algebra, that science might be strongly suspected to have a peculiar power of rejecting false suppositions, or of indicating their falsehood by refusing to furnish rational results: thus it certainly does generally happen that when we attempt to select from among series of integer powers he one belonging to an expression which really has no such series, we find infinite coefficients, or some other warning. But it is too much to ask of a beginner that he hould take it for granted that algebra has so peculiar a property; nor, in fact, is it true that such a property is quite universal. It is necessary therefore to watch all ransformations narrowly, both in their general as well as heir specific form: first, because there can be no sound easoning without such caution; next, because, though it s true that in many parts of algebra the science will refuse o acknowledge and obey a false assumption of form, yet it s almost impossible to draw the line at which this refusal nds, and the idea that such a power is universal in algebra will lead the student to many a serious difficulty in the igher branches of mathematics.

TRANSFORMATION OF COORDINATES. We intend this article purely for reference: that is, supposing he subject already known, we mean only to put together he formulæ in such a manner that any one can be used t once.

Rectilinear coordinates are the only ones which are usually transformed; such a thing rarely, if ever, happens with polar coordinates, except in investigations each of hich has its peculiar method. And first we shall conder rectilinear coordinates in one plane, and afterwards n space. What is usually wanted is to express the coorinates of a first system in terms of those of a second, and ubsequently given, system.

And first as to coordinates in one given plane.

1. *Both systems oblique.* Let x and y be the old coorinates of a point, x' and y' the new ones. Let μ and ν e the old coordinates of the new origin: θ the angle made y the old coordinates: ϕ the angle made by the axis of ' with x: ψ the angle made by y' with x. Angles are o be measured as explained in the article SIGN: thus the ngle made by x' with x means the amount of revolution hich would bring the positive part of x into the direction f the positive part of x', the revolution being made in the ositive direction.

$$x-\mu = \frac{\sin(\theta-\phi)}{\sin\theta}\,x' + \frac{\sin(\theta-\psi)}{\sin\theta}\,y'$$

$$y-\nu = \frac{\sin\phi}{\sin\theta}\,x' + \frac{\sin\psi}{\sin\theta}\,y'.$$

2. *The old system oblique, the new one rectangular.* Here $\psi-\phi$ is a right angle, and

$$x-\mu = \frac{\sin(\theta-\phi)}{\sin\theta}\,x' - \frac{\cos(\theta-\phi)}{\sin\theta}\,y'$$

$$y-\nu = -\frac{\sin\phi}{\sin\theta}\,x' + \frac{\cos\phi}{\sin\theta}\,y'.$$

3. *The old system rectangular, the new one oblique.* Here, in (1), θ must be a right angle.

$$x-\mu = \cos\phi . x' + \cos\psi . y'$$
$$y-\nu = \sin\phi . x' + \sin\psi . y'.$$

4. *Both systems rectangular.* Here θ and $\psi-\phi$ are both right angles.

$$x-\mu = \cos\phi . x' - \sin\phi . y'$$
$$y-\nu = \sin\phi . x' + \cos\phi . y'$$

5. *The coordinates of the new system parallel to those of the old one.* Here

$$x-\mu = x', \quad y-\nu = y'.$$

In any of the preceding cases, if the new and old origin coincide, we have only to make $\mu=0$, $\nu=0$, and use the formulæ accordingly.

Next, when the coordinates are those of points in space. The only two cases which are particularly useful are when both systems are rectangular, and when the new one only is oblique. Let x, y, z be the old coordinates, and x_1, y_1, z_1 the new ones. Let λ, μ, ν be the old coordinates of the new origin, and let the angle made by x_1 and y_1 be ζ, that of y_1 and z_1 be ξ, and that of z_1 and x_1 be η, which we may thus denote:—

$$\widehat{x_1 y_1} = \zeta, \quad \widehat{y_1 z_1} = \xi, \quad \widehat{z_1 x_1} = \eta.$$

Then we have the following formulæ:—

$$x-\lambda = \alpha x_1 + \beta y_1 + \gamma z_1$$
$$y-\mu = \alpha' x_1 + \beta' y_1 + \gamma' z_1$$
$$z-\nu = \alpha'' x_1 + \beta'' y_1 + \gamma'' z_1.$$

Where the meanings of α, β, &c., and the connection of those meanings with the places of the letters in the formulæ, will be easily caught from the following:—

$$\alpha = \cos\widehat{x x_1}, \quad \beta = \cos\widehat{x y_1}, \quad \gamma = \cos\widehat{x z_1}$$

$$\alpha' = \cos\widehat{y x_1}, \quad \beta' = \cos\widehat{y y_1} \quad \gamma' = \cos\widehat{y z_1}$$

$$\alpha'' = \cos\widehat{z x_1}, \quad \beta'' = \cos\widehat{z y_1} \quad \gamma'' = \cos\widehat{z z_1}.$$

And α, α', &c. are subject to the following six conditions:—

$$\begin{array}{ll}
\alpha^2+\alpha'^2+\alpha''^2=1 & \beta\gamma+\beta'\gamma'+\beta''\gamma''=\cos\xi \\
\beta^2+\beta'^2+\beta''^2=1 & \gamma\alpha+\gamma'\alpha'+\gamma''\alpha''=\cos\eta \\
\gamma^2+\gamma'^2+\gamma''^2=1 & \alpha\beta+\alpha'\beta'+\alpha''\beta''=\cos\zeta.
\end{array}$$

This case is not much required: the following, in which both systems are rectangular, is of the highest importance. When we speak of the angle made by two axes, we mean, as before, the angle made by the positive side of one with that of the other; but, since only cosines are used, the direction of revolution is immaterial. If both systems be rectangular, and if they have the same origin, we have two sets of equations, each of which follows from the other, one set being in each column: the meanings of α, α', &c. being as before,

$$\begin{array}{c|c}
x=\alpha x_1+\beta y_1+\gamma z_1 & x_1=\alpha x+\alpha' y+\alpha'' z \\
y=\alpha' x_1+\beta' y_1+\gamma' z_1 & y_1=\beta x+\beta' y+\beta'' z \\
z=\alpha'' x_1+\beta'' y_1+\gamma'' z_1 & z_1=\gamma x+\gamma' y+\gamma'' z \\
 & \\
\alpha^2+\alpha'^2+\alpha''^2=1 & \alpha^2+\beta^2+\gamma^2=1 \\
\beta^2+\beta'^2+\beta''^2=1 & \alpha'^2+\beta'^2+\gamma'^2=1 \\
\gamma^2+\gamma'^2+\gamma''^2=1 & \alpha''^2+\beta''^2+\gamma''^2=1 \\
 & \\
\beta\gamma+\beta'\gamma'+\beta''\gamma''=0 & \alpha'\alpha''+\beta'\beta''+\gamma'\gamma''=0 \\
\gamma\alpha+\gamma'\alpha'+\gamma''\alpha''=0 & \alpha''\alpha+\beta''\beta+\gamma''\gamma=0 \\
\alpha\beta+\alpha'\beta'+\alpha''\beta''=0 & \alpha\alpha'+\beta\beta'+\gamma\gamma'=0
\end{array}$$

Besides which, each of the quantities α, α', &c. may be expressed in terms of the others, as follows:—

$$\begin{array}{lll}\alpha=\beta'\gamma''-\gamma'\beta'', & \beta=\gamma'\alpha''-\alpha'\gamma'', & \gamma=\alpha'\beta''-\beta'\alpha'' \\ \alpha'=\beta''\gamma-\gamma''\beta, & \beta'=\gamma''\alpha-\alpha''\gamma, & \gamma'=\alpha''\beta-\beta''\alpha \\ \alpha''=\beta\gamma'-\gamma\beta', & \beta''=\gamma\alpha'-\alpha\gamma', & \gamma''=\alpha\beta'-\beta\alpha'.\end{array}$$

For the mode in which these nine quantities are made to depend upon three, we must refer to works on mechanics, in which such reduction is particularly useful. We avoid giving it here, because trifling differences exist in the manner of taking the quantities to functions of which all the rest are to be reduced, so that no set of equations can be given which can be called universal. As far as we have gone, the expressions of all writers are the same, though the letters used are not always alike.

TRANSFUSION OF BLOOD is the operation of transferring the blood of one animal into the blood-vessels of another, and is sometimes beneficially employed for reviving those who are nearly dying after severe hæmorrhage. The operation had long been used as a means of experiment, and in the vain hope that by injecting the blood of a healthy man or animal into the vessels of a diseased one, the health of the latter would be restored; but it had rarely been employed for its only useful purpose, till Dr. Blundell, after a long series of well-conducted experiments on animals, proved that it might be safely and advantageously employed in men. His observations are published in his 'Physiological and Pathological Researches;' and since his revival of the operation, the lives of many persons have been saved who were, in all probability, dying from the loss of blood during or after surgical operations, during gestation, and in other circumstances. The operation has indeed often failed; it has often been unnecessarily performed; and its performance is not unaccompanied by danger to the patient; but still there is sufficient evidence of its high utility in cases which, without it, would have been quite or nearly hopeless, to warrant its being resorted to under the guidance of a sound judgment.

The chief instruments employed in the operation are a syringe, with double pipes, a basin of appropriate form, and a fine tube fixed on one of the pipes of the syringe. One of the veins of the arm of the patient being opened just sufficiently to admit the point of the tube, and fixed by a probe, blood must be drawn through a free opening in the vein of some healthy person, and as it flows into the basin must be slowly sucked up, without any mixture of air, by the syringe. When the syringe is filled and carefully cleared from all air by forcing blood up to the very point of the tube, the latter must be introduced into the patient's vein, and the blood steadily and slowly injected. Four or five ounces are often sufficient to revive a patient, and if they produce head-ache, flushings of the face, tendency to fainting, and other unpleasant symptoms, the transfusion should be arrested; but if not, the injection should be continued till it produces some good effect, or till a pint of blood has been transfused. Beyond this it is not safe to carry the operation, nor is it likely to be beneficial. A second or a third injection may be employed when the state of the patient seems to render it necessary.

The experiments of transfusing the blood of various animals into the vessels of man proved only mischievous; and those of transferring the blood of an animal of one species to the blood of another species are of too little interest and have produced too few general results to be worth recording here. The injection of various medicinal substances into the veins has been tried, but its effects are not sufficiently different from those produced by the ordinary mode of taking medicine, to render it advisable to submit to an operation which is itself dangerous. All the important facts relating to the subject may be read in an article on Transfusion, by Dr. Kay, in the 'Cyclopædia of Practical Medicine,' and in the works from which he quotes.

TRANSIT, or TRANSIT INSTRUMENT (*Instrument des Passages*), was invented by Römer about the year 1690. The description is to be found at page 47 of the 'Basis Astronomiæ,' by his pupil Horrebow, Havniæ, 1735; and we recommend the perusal of this book, which contains an account of Römer's inventions and methods, to all those who, reading Latin with moderate ease, feel a desire to learn the origin of modern practical astronomy.

The object of the present article is to give such an account of the transit as will enable any one to use it with tolerable success. Those who wish for more perfect information must consult the introductions to the Greenwich, Königsburg, Dorpat, Cambridge, Edinburgh, &c. Observations. Our type will be the *portable* transit-instrument, leaving the reader to accommodate what is here said to the powers of his own instrument, or to the practice of the observatory which he adopts for a model.

There are three principal parts expressed in the plate. The iron stand, carrying the Y's with their adjustments: the telescope, inserted at right angles through an axis with a small vertical circle for finding or verifying stars; and the cross level. The stand is made of cast-iron, and should be of great strength, though perhaps that which is here figured would be found inconveniently heavy if the instrument is often moved. The Y's are contained in brass pieces, strongly united to the tops of the two uprights. The left hand Y has a motion up and down, which is given by a milled screw partially seen immediately under the pivot. The right hand Y is moved in azimuth by a screw, the milled head of which is seen projected upon the lantern. In portable instruments it is very convenient to have this lateral or azimuthal adjustment made by screwing against a spring, as it is in this instrument. In fixed observatories the adjustment is made by two antagonist drawing screws, one of which is tightened and the other loosened; and indeed this is the general construction of instruments of every size, and is the most solid fixture. But it is so convenient to be able to move the instrument at pleasure in azimuth while actually looking through the telescope, that we should strongly recommend the adoption of the counter-spring whenever the instrument is small, and is either to be frequently shifted, or is not furnished with a meridian mark. The spring must press pretty strongly against the screw, and there should be a clamping button in each adjustment, to keep all secure.

The axis is made of two strong brass cones soldered on the central sphere. The sphere is cast hollow with two shoulders, over which the cones slip. As this is the most important part of the instrument, great care should be taken of the fitting before the axis is finally put together, and the symmetry of the parts as to the centre should be perfect. If the instrument is weak here, it is utterly worthless. In the older English instruments the centre was a cube, and that form is frequently adopted at present by continental artists. The transit at Bruxelles by Gambey, one of the largest and finest instruments in the world, is so constructed. The essential requisite however is *symmetrical strength*, and any shape is good which fulfils this condition. The pivots are soldered into the extremities of the cones, and are turned after the whole is fixed. One of them is pierced to admit light into the axis. In large instruments the pivots have an outer surface of steel, which is less affected by wear. Greater care is required to guard steel pivots from rust,* and the turning must be performed with a diamond cutter, as the hard knots to which steel is subject resist and jar the ordinary cutter out of its place. The pivots should be turned pretty nearly to the same diameter: the marks of the tool are ground off afterwards by collars which are made to fit closely on the pivots, and are changed and reversed from time to time. When the surface is perfectly formed, the grinding should be discontinued, as a small difference of size in the pivots is of little consequence, while an alteration of the cylindrical form of the pivots, or of the direction of their axes, ruins the instrument. The perforated or *illuminated* end of the axis is on the right-hand pier in this figure. The light of the lantern shines through this and lights up an annular plate in the centre, which makes an angle of 45° with the axis and with the telescope, and thus light enough is thrown down to the eye-end to illuminate the field very vividly, while the opening allows the rays from the object-end to pass without impediment. The quantity of light may be regulated by a contrivance for diminishing the aperture of the lantern, or by a shade passing between the lantern and the pivot. In some

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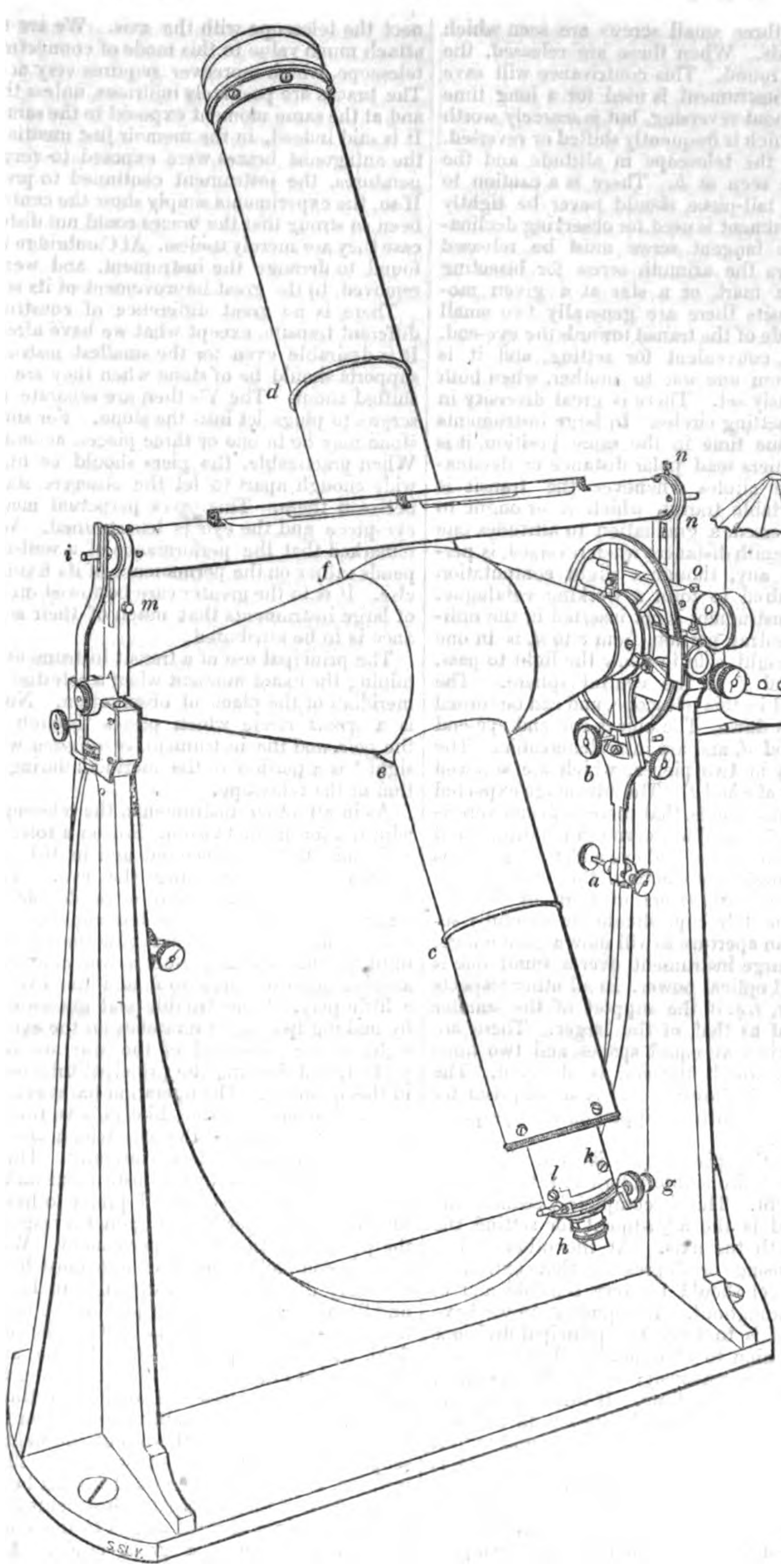
* When the instrument is small and frequently out of use, it should be removed from the Y's, and the pivots protected by caps which slip closely over them.



Transit Instrument.

transits there is a contrivance for altering the angle of the central reflector in the body of the instrument; but this, although very handy, is objectionable, as affecting the symmetry of the instrument. In a thirty-inch transit the lantern is within reach, and may be twisted a little, so as to reduce the light at pleasure. The setting circle, with its level and clamp, are towards the illuminated end of the axis. The tail-piece, which is attached to the verniers and level, is held between the rounded ends of the two screws at *a*. By screwing one and loosening the other, the bubble of the level is brought to the middle, when the vernier points out the reading of the circle. There is a lens and reflector, for lighting and reading off the circle. The instrument here figured has a vernier which reads single minutes; but the vernier is inconveniently long for a fixed lens, and we should prefer reading to every 2′, which is more than sufficiently near for finding or identifying stars. If the small circle is carefully looked at, two out of three small screws are seen which fix the circle to the axis. When these are released, the circle will turn freely round. This contrivance will save some trouble when an instrument is used for a long time in the same place without reversing, but is scarcely worth being applied to one which is frequently shifted or reversed. The clamp for fixing the telescope in altitude and the slow-motion screw are seen at *b*. There is a caution to be given here. The tail-piece should never be tightly nipped, unless the instrument is used for observing declinations, and it and the tangent screw must be released when the observer uses the azimuth screw for bisecting any object, such as a mark or a star at a given moment. In large transits there are generally two small circles fixed on each side of the transit towards the eye-end. They are here more convenient for setting, and it is easy to pass rapidly from one star to another, when both the circles are previously set. There is great diversity in the graduation of the setting circles. In large instruments which are used for some time in the same position, it is best to make the verniers read polar distance or declination, re-adjusting the circles whenever the transit is reversed. With a portable transit, which is or ought to be very frequently reversed, a graduation to altitudes one way, which becomes zenith distances when reversed, is perhaps as convenient as any, though a slight computation for each star is required to form a working catalogue. The telescope in this instrument is not inserted in the ordinary manner. The central portion, from *c* to *d*, is in one tube, pierced on the right side to allow the light to pass, and soldered at *e* and *f* to the central sphere. The reflecting plate is fixed in this telescope, and can be turned to throw the light up or down. The object-end and eye-end are screwed on at *c* and *d*, and are interchangeable. The telescopes are usually in two pieces, which are screwed into the central sphere at *e* and *f*. The advantage expected from the present construction is, that there is firmer screw-hold and less leverage for any blow or rough handling; and that by interchanging the object and eye end, fresh portions of the pivots are brought into action, thus diminishing wear and equalizing minute errors of form or flexure. The object-glass of the telescope should be carefully selected, and of as large an aperture as will show a good image. The superiority of a large instrument over a small one is wholly in the increased optical power. In all other respects it is probably inferior, *i.e.* if the support of the smaller instrument be as solid as that of the larger. There are seven fixed vertical wires at equal spaces, and two horizontal wires, between which the star is observed. The head of the micrometer is shown at *g*. A small prism for observing stars near the zenith is slipped on the eye-piece when required, as at *h*.

The level *rides* on the pivots with its Y's. There is a pin at each end, which drops into a fork at *i*, to hold the level safely and upright. This is completely seen at the left pier. At this end is the adjustment for setting the level tube parallel with the axis. At the other end is an adjustment for raising or depressing that extremity of the level. The level should be very sensible and of the same curvature throughout. The graduation we have found most convenient is to have the principal divisions to 15″ and the subdivision to 1″·5, numbered as units and tenths, which, though erroneously, is briefly described by calling the units seconds of time. If this scale should be too fine for the level, a principal division to 30″ and subdivisions to 3″, but still numbered as units and tenths, will be found equally convenient. The riding level is generally applied to the instruments which are so large, and consequently the piers so high, that a man cannot apply the level safely while standing on the floor, and also to small instruments, of necessity, when they are clamped, as this is, to the pier. For a transit between stone piers which does not exceed five or six feet, we prefer a swinging level, which may be applied and read while standing on the floor.

When Troughton undertook, much against his will, to construct a ten-foot transit for the Royal Observatory, he adopted a very ingenious mode of uniting the cones and the telescope with the central sphere. The description will be found in the 'Phil. Trans.' for 1826, p. 423: that part which treats of the construction of the instrument is from Troughton's own pen. He also added four braces, to connect the telescope with the axis. We are not disposed to attach much value to this mode of connecting the axis and telescope, which moreover requires very accurate fitting. The braces are positively injurious, unless they are exactly and at the same moment exposed to the same temperature. It is said indeed, in the memoir just mentioned, that when the antagonist braces were exposed to very different temperatures, the instrument continued to preserve its form. If so, the experiments simply show the centre-work to have been so strong that the braces could not disturb it, in which case they are merely useless. At Cambridge the braces were found to derange the instrument, and were consequently removed, to the great improvement of its steadiness.

There is no great difference of construction between different transits, except what we have already mentioned. It is desirable even for the smallest instruments that the supports should be of stone when they are not perpetually shifted about. The Y's then are separate pieces fixed by screws to plugs let into the stone. For small transits the stone may be in one or three pieces, according to the size. When practicable, the piers should be high enough and wide enough apart to let the observer stand or lie down between them. This saves perpetual meddling with the eye-piece and the eye is less strained. We have already remarked that the performance of a well-made transit depends rather on the permanence of its fixing than anything else. It is to the greater care bestowed on the foundations of large instruments that much of their superior performance is to be attributed.

The principal use of a transit instrument is that of determining the exact moment when a celestial body passes the meridian of the place of observation. Now the meridian is a *great* circle which passes through the *zenith* and the *pole*, and the instrument is *adjusted* when the line of sight [*] is a portion of the meridian during the whole rotation of the telescope.

As in all other instruments, the telescope is first to be adjusted for distinct vision. Put on a tolerably high power, and slide the eye-piece out and in till you see the wires sharply without straining the eye. Then direct the telescope to a bright star or a double star; and if the image of it is distinct, the telescope is in focus. If not, release the screws at *k*, and draw the tube out or push it in until the image is as perfect as you can make it. There is another opposite screw to *k*, and the exterior holes allow a little play. Some trouble and guesswork may be saved by making two slight scratches on the eye-piece where the sight of the wires and of the star are respectively most perfect, and drawing the principal tube out or pushing it in this quantity. The operation has succeeded, if, in viewing a slow-moving star, like Polaris, there is no shifting between the star and the wire which bisects it, while the observer moves his head laterally. This adjustment is generally best made by the instrument-maker, and as it is not liable to alter, we should prefer to have the telescope tube cut the proper length upon his responsibility, so that the position of the wire is permanent. When this adjustment is completed, the telescope must be turned on some tolerably distinct object, which is to be bisected by the middle wire near the upper part of the field: if on raising the telescope it is also bisected at the lower part of the field, the wire is perpendicular to the axis; but if not, the tube is to be twisted without altering the focal length until the object comes half way to bisection: the bisection is completed by the azimuth-screw, when the object ought to be seen bisected at the top of the field when the telescope is depressed. One or two trials will suffice for this purpose, and then the screws at *k* must be tightened.

The first of the principal adjustments is that of setting the line of sight at right angles to the cross-axis, when it necessarily describes a great circle. A distinct object must be selected not far from the horizon, and bisected by the middle wire, using the azimuth screw. The axis is then carefully lifted out of its Y's, and returned end for end, or *reversed*, and the object viewed again. It is now to be bisected as before, half by moving the azimuth-screw, and half by the screw at *l* and its antagonist, each of which *draws* the plate on which the wires are fixed. The operation must be repeated until no dif erence can be seen in the bisection, whichever be the position of the axis. When there is a micrometer, the operation is somewhat easier. The micrometer wire is brought first on one side and then on the other of the centre wire, so as just to shut out the light between them, and the mean of these two readings is the reading of the zero point, that which corresponds to the exact superposition of the wires. The distinct object is bisected by the micrometer wire; and we will suppose that the screw has to be turned three revolutions for this purpose from its zero position. Now reverse the axis, and suppose the micrometer has only to be moved two revolutions from its zero to bisection. The half-way, or two revolutions and a half, is the distance which should be shown. Carry the micrometer wire two revolutions and a half back from its ast position, and that is the position which the centre wire should occupy. If the joint thicknesses of the two wires (previously determined) equal ten parts, carry the micrometer five parts still farther back, and bring up the middle wire to touch it by the screws at *l* as before. The error of collimation is now corrected, as will be found by repeating the observation. The collimating screws have generally a capstan-head, which is awkward, and indeed dangerous so near the eye; and we think the square head, which is turned by a key, is more manageable. The screws should be drawn tight, but not forced. We have here followed the usual rule of directing the observer to select a well-defined object near the horizon. If the pivots of the axis are equal, the mark may be considerably elevated or depressed without introducing any error; and an object which is not very distant may be seen sharply defined when the aperture of the object-glass is diminished. In fixed observatories there is usually either a meridian mark north and south at a considerable distance, or two near marks, which are made distinct by interposing lenses. At Greenwich and Cambridge a south meridian mark is combined with a supplementary transit in the north slit: at Oxford two near marks are made visible by lenses fixed in the observatory slits. By using north and south marks at the same time, you are warned of any alteration in the Y's during the reversal, which, when the instrument is heavy, is always to be feared. Such shifting would cause the error of collimation to appear different according as it is taken from one or the other mark. In standard observatories the error of collimation is not actually corrected unless it is large, but measured by the micrometer, as we have described, and the effect thus allowed for by calculation.

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[*] We shall speak at present as if there were only one fixed wire in the telescope, viz. the middle vertical wire. The subsequent modification will cause no difficulty.

When the illuminated end is west and telescope pointing south, let the middle wire *appear* to be 3·263 Revolutions to the right-hand of the collimating mark: as the telescope reverses, this means that the transit points 3·263 R. to the left of the mark, or to the *east*. Now reverse the telescope, the illuminated end is east, and suppose the middle wire still to appear to the right of the mark, but only 3·187 R. These observations are best made on a calm cloudy day; often, after rain, the mark, if distant, is seen sharply and steadily. If there were no error of collimation, the micrometer should give the same quantity at both observations, or $\frac{1}{2}$ (3·263 R. + 3·187 R.), that is, 3·225 R. The error in collimation therefore is 0·038 R., and the instrument points to the east that quantity when the illuminated end is west. The scale of the micrometer screw is known. Let one revolution correspond to the space an equatorial star would move over in 3^s of time; then 0·038 R. is the space which an equatorial star would move over in $0^s\cdot114$, which is set down as the error to be employed in calculation. Now the effect of an error of collimation is to make the instrument describe a parallel to a great circle, and distant from it by the collimation error. If the instrument points to the east of the south, it also points the same quantity to the east of the north, and a star above pole will pass the *apparent* before the *true* meridian. The correction therefore to be applied to the observed transit is +, and when the instrument is reversed will be −. The time which a star takes to pass between the two circles, or the *correction*,

is equal to the $\frac{\text{error of collimation}}{\text{cos. declin. of star}}$, or, in the supposition we have made, is—

$*+0^s\cdot114$ sec. declin. Ill. end West.
$-0^s\cdot114$ sec. declin. Ill. end East.

The sign changes for stars *sub polo*.

The next adjustment is to make the axis horizontal. If the poles of motion are in the horizon, the great circle which the instrument, freed from collimation, describes, must pass through the zenith. Put on the level, and bring the bubble into the middle. Now rock it a little to and from the observer, and see whether the bubble still remains in the same place. If in pushing the level from you the bubble runs towards the left hand, this shows that the level tube itself is set askew upon its support, and that the left end, being nearest the observer, is elevated by that motion above the right end. Screw the small screw seen at *m*, and release its antagonist (these are *pushing* screws) until a considerable rocking motion scarcely moves the bubble at all. There is generally a cross level, to show when the principal level is upright; and this should be brought to have its bubble in the middle, when the principal level has been adjusted as above. The fork in the present example serves the same purpose when the level itself has been carefully adjusted. To level the *axis*, bring the bubble of the level to the same reading at each end (the numeration of the division is supposed to begin from the centre) by the elevating screw at the left hand Y. Reverse the level and bring the ends again to the same reading, half by the elevating screw of the Y, and half by the two screws seen at *n*, which raise or depress the level tube in its supports. On returning the level to its first position, the bubble should still be in the centre; but if not, it must be brought there, half by the Y elevating screw and half by its peculiar screws; and the operation must be repeated till this is effected, *i. e.* if the observer cannot or will not calculate the effect of a small error, which may easily be measured. If he can (and there are few observers at present who cannot), the process is pretty much as follows. The graduation being supposed to be units each equal to 15″.

Illuminated end West. Telescope South. Altitude 45°.
Observer North.
Level.
East end of bubble $4^s\cdot76$. West end $5^s\cdot84$.

The level is now reversed end for end, and the two ends again read off:

East end $5^s\cdot24$. West end $5^s\cdot34$.
Mean, East $5^s\cdot00$. West $5^s\cdot59$.

which is the reading which the level would show in both positions if *it* were in adjustment. Hence the west end is higher than the east by half* the difference, or by $0^s\cdot295$. The level should be applied in reversed positions several times, and a mean taken.

Now let the telescope itself be reversed, and suppose the following entries of observations to be made:—

Illuminated end East. Telescope North. Altitude 45°.
Observer North.

East	West
$4^s\cdot93$	$5^s\cdot66$
$5\cdot42$	$5\cdot19$
Mean East $5\cdot175$	Mean West $5\cdot425$

The difference is now $0^s\cdot25$, and the west end is consequently too high by half the difference, or by $0^s\cdot125$, a result which differs from the former (Illuminated end West) by $0^s\cdot17$. If the partial observations have been pretty accordant (we suppose $0^s\cdot17$ to be the mean result of a considerable number of observations), this difference between the values of the inclination, according to the position of the illuminated end, must be supposed to be owing to a difference in the pivots; and if so, a little consideration will show that to obtain the true inclination of the axis in the two positions, $\frac{1}{4}$ of $0^s\cdot17$ must be subtracted from the level error Ill. end West, and must be added to the error Ill. end East. The true level errors therefore are

Ill. West, $+0^s\cdot295-0^s\cdot042$, or $+0^s\cdot253$;
Ill. East, $+0\cdot125+0^s\cdot042$, or $+0\cdot167$.

By the mean of a great many careful observations made when the temperature is steady[*] and the sky overcast, the difference of the pivots, if it exists, is to be ascertained, and the correction due to that cause is to be applied to the indication of the level.

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* The rotation of the earth requires the *apparent* place of a star to be increased by $0^s\cdot0206$. cos. latitude × sec. of *'s declination. This comes to the same thing as subtracting $0^s\cdot0206$ × cos. latitude from the collimation correction. In lat. 51° 30′ this = $0^s\cdot013$. The corrections for collimation become
$+0^s\cdot101$ × sec. dec. * Ill. end West.
$-0^s\cdot127$ × sec. dec. * Ill. end East.

* If the unit were 30″, the west end would be higher by the whole difference.

The error of inclination in the axis being measured, the corresponding correction which is to be applied to the observations is thus computed:—If the west end of the transit axis be raised, it is clear that the circle perpendicular to that axis will continue to cut the horizon at the north and south points, but will pass to the east of the zenith, from which it will be removed by an arc equal to the inclination of the transit axis. All the stars above the pole will therefore appear to pass too early, and those below the pole will pass too late; and if the inclination be 15″, the effect in *time* upon any star will be

$$\frac{\cos \text{zenith distance}}{\cos \text{declination}} \times 1^{s}$$

Now the level graduated as we have described gives the inclination in parts of which 15″ is the unity; hence the corrections to be *added* to the observed times of passage of stars will be, using the previous example—

$$\text{Ill. end West} \quad +0{\cdot}253^{s} \times \frac{\cos \text{zen. dist.}}{\cos \text{declin.}} \text{ of star;}$$

$$\text{Ill. end East} \quad +0{\cdot}167^{s} \times \frac{\cos \text{zen. dist.}}{\cos. \text{declin.}} \text{ of star.}$$

The above corrections, for errors of collimation and inclination, are purely instrumental; and, as the reader will perceive, do not require any celestial observation. Before proceeding to the third adjustment, that by which the great vertical circle now described by the telescope is made to pass through the pole, it will be proper to mention how transit observations are actually made, and then describe how this error is corrected or computed. The instrument is in or very near the meridian; a star on entering the field is placed between the two horizontal wires. It will then gradually travel through the field, describing a parallel to the horizontal wires, and passing over the vertical wires in succession. The observer looks at his clock a little before the star comes to the first vertical wire, and counting the beats steadily forward by ear, determines as well as he can the second and decimal of a second at which the star is immediately under the wire. He writes this down, counting all the time, and goes through the same process at each of the seven wires with which his instrument is furnished. When the star has passed all the wires, he looks again at the clock to see that his count is right, and then sets down the hour and minute corresponding to the last wire. The habit of mentally counting on to sixty while writing down the observation is easily acquired. The estimation of the decimal of a second at which the star is covered by the wire is a matter of more difficulty, and, with some persons, requires considerable practice.[†] The observer is to attempt to fix in his mind the places of the star with respect to the wire at the preceding and succeeding beat, and to divide the second in proportion to the two spaces. Thus if at 16^{s} the star is rather nearer the wire, before passing, than it is at 17^{s}, after passing, he sets down $16^{s}{\cdot}4$: if he judges the proportion to be less than one to two, he sets down $16^{s}{\cdot}3$; and so on. Finally the mean of the observations over the seven wires is to be taken, which is to be used as the actual time of transit. It would be desirable that an observer should begin by learning to note the observation with considerable exactness, and, if it may be, under the care of a practised guide: but the observation is so simple, that every one acquires the power who has the will to try; and we believe that with a little experience one observer is nearly as good as another.

Before applying the instrument to actual observation, the adjustment of the level of the vertical circle must be examined, which we will suppose to read altitudes when the illuminated end is west, and zenith distances when the axis is reversed. Having levelled the axis approximately, bring the bubble of the small level to the middle by the screws at *a* which hold the tail-piece, fix these firmly, and then direct the telescope on some point, which is to be placed exactly on the horizontal wire if there is but one, or between the wires if there are two. Read off the vernier, which we will suppose to give an altitude of 4°. Reverse the axis and repeat the former observation; and now read the vernier, which we will suppose to give a zenith distance of 87°. The sum of these readings is 91°, while it ought to be 90°, showing an excess of ½ a degree in each reading. Now set the vernier at 86° 30′, clamp the screw at *b*, and, by the tail-piece screws at *a* bring the object to its proper place between the wires; finally bring the bubble of the small level to the middle by the antagonist capstan-headed screws, which are seen towards the end of the level at *o*. The instrument will now show true altitudes and zenith distances within 1′ if the operation has been nicely performed. When the vernier reads polar distances, the vernier must be set to the polar distance of a known star, the telescope brought to the star, and the bubble of the small level afterwards brought to the middle. The latitude of the place may generally be supposed pretty well known: if not, direct the telescope to the pole star, or δ Ursæ Minoris, when near their upper or lower culminations, or to the sun, or to any star which the observer can identify when it is nearly south or north. The altitude or zenith distance of a known object will give a latitude near enough for finding a star from its catalogued place, or for instrumental corrections.

We will now proceed to the azimuthal correction. If the time is known from any other observations, the middle wire of the transit may be made to bisect a star at the time when by calculation it should pass; and if this star be Polaris or δ Ursæ Minoris, the instrument will be very nearly in the meridian; but if the observer has nothing but a transit instrument and a chronometer, he must place it as near as he can guess in the meridian,[*] and level the axis pretty carefully. A moderate knowledge of the heavens will tell what known star is likely to pass soon; and the instrument having been set to the proper altitude (or sweeping for it), the observer must wait patiently till it enters the field. The observation is then made in the manner already described. If the star is near the zenith, this alone will give an approximate clock-error. Now compute the time a star near the pole or horizon should pass, and bisect the star by the middle wire at the computed time. If the error in the position of the instrument is too large to be corrected by the azimuth screw, the stand must be shifted bodily a sufficient angle, and the instrument levelled afresh. In two or three trials it is easy to get the error within command of the azimuth screw; and the observer, if he dislike calculation, may continue getting his clock-error by a star near the zenith, and then bisecting a star near the pole or horizon at the calculated time with the azimuth-screw, until all stars, high and low, give the same clock-error. The instrument is then in the meridian and the clock-error is the true one. This tentative process may however be considerably abridged by a little easy calculation, which we will proceed to explain.

The errors of collimation and inclination being supposed to be annulled, either by adjustment or calculation, the line of sight describes a great circle passing through the zenith and not far from the pole. On drawing the figure, and supposing the deviation to be to the east of the south and west of the north, it will be seen that the effect of the error is to cause all stars between the south horizon and the zenith to pass too early, as well as all stars *sub polo*: while stars between the zenith and pole pass too late. The effect upon the passage of a star is proportional to $\frac{\text{sin. zenith distance}}{\text{cosin. declination}}$ of star. If x be assumed to be the amount of the deviation to the east of the south, measured in units of 15″, and the latitude of the place and the declination of the star be denoted respectively by ϕ and δ, the correction to be *added* to the observed passage of each star in respect of the error of deviation is $\frac{\sin(\phi-\delta)}{\cos\delta} \times x^s$.[*] Now suppose two stars, s and s', to be observed, which differ a good deal in declination, and let the values of $\frac{\sin(\phi-\delta)}{\cos\delta}$ for these stars be p and p': then $s + px$ and $s' + p'x$ are the times at which the stars would have been observed if the instrument had been in the meridian. The interval therefore between their transits thus corrected (and also corrected for the rate of the clock, if necessary) will be equal to the difference of their right ascensions, which may be taken from the 'Nautical Almanac,' if the stars are contained in its list, or must be computed from some good catalogue, if they are not. Let the right ascensions of the two stars be a and a', and we have the following equation :—

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[*] By adding the two readings together, you have the length of the bubble, which, if the temperature is steady, will continue to be of the same value during the series, but will grow shorter by heat. The level should be exposed some time before it is used. The coherence in the values of the length is a proof of the goodness of the observations. If the bubble continue to be of the same length when the zero is changed, it is probable that the curvature is uniform. After the level has taken the temperature of the air, about a minute should be given for it to settle after each application, but not more than two. The observer should learn to read the level rapidly and boldly, as the zero changes if a light is held near to it for many seconds.

[†] Success will depend a good deal on the definition and magnifying power of the telescope, and also on the sharpness of the wires and the beat of the clock. The advantage of a distinct audible beat is very often entirely overlooked by clock-makers who are not observers.

[*] If a line be drawn from Polaris between the fifth and sixth stars of the Great Bear, and a point taken in this line about 1½° from Polaris, the transit directed to this point will scarcely be 1° from the meridian. With a little practice one may come nearer than this at once.

$$(s' + p'x) - (s + px) = a - a.$$

$$\text{or } x = \frac{(a' - a) - (s' - s)}{p' - p} \text{ [†]}$$

If the value of a revolution of the azimuth screw is known, it is easy to correct for this error at once with considerable accuracy. If x exceed 1^s or 2^s, it must be reduced to those limits. Should x be negative, the deviation is to the west of the south.

The accuracy of the determination of x depends, *cæteris paribus*, upon the stars which are used for the computation, *i. e.* upon the value of the denominator of the above fraction, which should be as large as possible. The most favourable condition is, that both stars should be near the pole, one above and the other below: δ Ursæ Minoris and Cephei 51 Hevelii present this combination. It is always desirable that one of the stars should be pretty near the pole—Polaris, if possible. If the instrument is nearly in the meridian, it is better not to touch the azimuth screw, but to determine the value of x by grouping the stars together, in which $\frac{\sin(\phi-\delta)}{\cos\delta}$ is nearly of the same magnitude with the same sign. The value of x may afterwards be used to correct each star separately, and the transits thus corrected will be very nearly such as *would* have been made if the instrument had been exactly placed in the meridian.

In fixed observatories the meridian error is obtained when possible from consecutive transits of Polaris above and below pole. The observations are corrected for collimation and inclination, and for the rate of the clock. If the times of passage thus corrected differ twelve hours, there is no meridian error; but if the difference is greater or less than twelve hours, the deviation may be computed thus:—Let s and s' be observed times of upper and lower culmination, corrected for collimation, inclination, and rate: let a and a' be the apparent right ascension of Polaris, taken from the 'Nautical Almanac;' x^s the deviation as before; $-p$ and p' the values of $\frac{\sin(\phi-\delta)}{\cos\delta}$ for Polaris above and below pole, which have different signs. Then, exactly as before, $s - px$, and $s' + p'x$, will be the corrected times of transit, and

$$(s' + p'x) - (s - px) = a' - a,$$

$$\text{or } x = \frac{(a' - a) - (s' - s)}{p' + p}.$$

When three consecutive transits are observed, there is no need of taking any account of the rate of the clock (which is supposed to go uniformly), or the change in right ascension of Polaris in the interval; only a mean is taken of the first and third transits, which is compared with the second. The difference between these, divided by $p' + p$, gives the value of x. The sign may be made out by seeing whether the passage from upper to lower culmination is too small, and from lower to upper culmination too large, when the deviation is to the west of north, and therefore to the east of south, and the correction is to be *added*, or *versâ vice*, when it is to be subtracted.[*] In well-regulated observatories Polaris is always observed when it is convenient, and often when it is not; and the right ascension of the star, as well as the position of the instrument, is deduced from these double transits. When the right ascension is thus perfectly known, single transits of Polaris may be safely used in combination with other stars, to determine the azimuthal error for those times of the year when the star at one of its culminations passes altogether unseasonably. It is assumed, in this method, that the position of the instrument is the same for twenty-four hours; or that it changes uniformly.

If the reader has fully understood what precedes, he will have no difficulty in comprehending the mode of observing and reducing the observations which is followed at Greenwich and our principal observatories; but the private observer cannot always command a site which is wholly to be relied upon, and very seldom can afford the time for such an uninterrupted series of observations as is required to give full effect to the system just described. The precautions to be taken will depend mainly upon the objects he has in view, but, generally speaking, the private transit observer will do wisely to take the places of the principal fixed stars from the lists furnished by Greenwich, though he may subsequently modify the values *inter se* by his own observations. Having done this, it will be easy for him to fix any other object with perfect accuracy, or to determine his time most scrupulously, although the steadiness of his transit is not beyond suspicion, and his avocations or inclination should only allow him to observe by fits and starts. We shall proceed to show how he may proceed under different hypotheses.

If he has a distant mark or a collimating telescope [see COLLIMATOR] with a micrometer to his transit, he proceeds exactly as we have described above to measure the quantity and direction of the collimation, the quantity and direction of the inclination, and then observes away, only taking care to note as many standard stars as will give him a correct clock-error, and at least some so far apart as will enable him to detect his azimuthal error. If he observe one or two stars near the pole, so much the better. Now calling ϵ the correction for the clock at the mean of the time of the observations of standard stars; s, s' s'', &c., as before the observed times of transit, corrected for collimation and level as aforesaid; p, p', p'', &c., with their proper signs, the correcting factors of the unknown azimuth x; and a, a', a'', &c., the apparent right ascensions of the standard stars, he has the following series of simple equations :—

$$\begin{gathered} s + \epsilon + p\,x = a \\ s' + \epsilon + px' = a' \\ s'' + \epsilon + px'' = a'' \\ \text{\&c.} \quad \text{\&c.} \quad \text{\&c.} \end{gathered}$$

Group together the equations in which the coefficient of x is nearly of the same magnitude and with the same sign,[†] and dividing each group by the number of its component parts, so as to have ϵ with unity as a coefficient, form at least two equations in which the coefficients of x differ considerably, and subtracting one from the other, a value of x will be found with its proper sign. Substituting this value of x in each of the equations $\epsilon = a - s - px$, you will have as many values of ϵ as you have equations; and taking the mean of those which are derived from the quick moving-stars, you have a good clock correction. Now if any other objects have been determined, the right ascension of which is required, add (speaking algebraically) the sum of all the corrections for collimation, inclination, declination, and clock-error to the observed transit, and you will have the *apparent* right ascension.

But it most frequently happens that the observer has no collimating mark and no micrometer to his instrument;

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[*] Throughout we shall assume the latitude to be north: when the declination is south, the sign of δ is changed, and $(\phi - \delta)$ becomes $(\phi + \delta)$. North of the zenith the numerator is negative, and the correction is to be subtracted between zenith and pole. Below the pole the cos. δ becomes negative (reckoned through the pole), and the correction becomes additive, as at first.

[†] Substituting for p' and p their values, the denominator of this fraction $= \frac{\sin(\phi-\delta')}{\cos\delta'} - \frac{\sin(\phi-\delta)}{\cos\delta} = \cos\phi\,(\tan\delta - \tan\delta')$ or $= \cos\phi \frac{\sin(\delta-\delta')}{\cos\delta\,\cos\delta'}$. This last is the usual form for computing the azimuth by a high and low star.

[*] To prevent mistake, we shall always speak of the quantity which is to be applied to the observation to make it correct.

[†] If two known circumpolar stars, like δ Ursæ and Cephei 51 Hevelii, are observed, subtract one of these equations from the other, and you have an equation in which x has a large coefficient, and therefore a good determination; if Polaris is well observed, use it singly, and group the standard stars together which have not more than 30° or 40° declination. It is very desirable that the number of close circumpolars in the Nautical Almanac should be considerably increased for this very purpose.

nay, he may only have a view out of a window* which commands no distant or distinct object, and not be able to see even the zenith, much less the pole. This last is the greatest objection; for the accuracy of the meridian adjustment depends chiefly upon getting stars near the pole. To detect the error of collimation the observer must proceed thus:—After having carefully determined the inclination of the axis, he observes as many well-known stars as he can, especially getting them as high and as low as possible for ascertaining azimuthal error. He must then reverse the axis, repeating the measurement of the inclination, but by no means touching the elevating screw of the instrument, and make a similar set of observations. A series of equations must be formed for each position of the instrument, which will be of the following form:—supposing s, s', s'', to be the observed transits of the stars corrected for inclination *only*; q, q', q'', to be the values of the secant of declination for each star respectively; c, the unknown value of the collimation error in the first position (which becomes $-c$ when the instrument is reversed); x, the error of deviation; and ϵ the clock correction,—

$$s+\epsilon+qc+px=a$$
$$s'+\epsilon+q'c+p'x=a'$$

and so on, for the stars first observed, and

$$s''+\epsilon-q''c+p''x=a''$$
$$s'''+\epsilon-q'''c+p'''x=a'''$$

and so on, for the stars of the second set after the instrument is reversed.

The mode of treating these equations will differ according to circumstances. They might be solved by the method of least squares; but it is scarcely worth while in ordinary cases to use any such refinement. Form four groups, two in each set, those in which x has the largest, and those in which x has the smallest coefficients, dividing each group by the number of its component parts, so as to leave ϵ with unity for its coefficient. Call these equations 1, 2, 3, and 4. Subtracting 4 from 1, we shall eliminate ϵ, c will have a + coefficient exceeding 2, and x in the most difficult case, *i. e.* when the observer can only look to the south, has a small positive coefficient. Again subtracting (3) from (2), we shall have c with a positive coefficient exceeding 2, and x with probably a small negative coefficient. From these two equations c can be determined pretty accurately. Substitute this value in equations (1) (2) (3) and (4), group (1) and (3) together, and (2) and (4) together, and we have a pair of equations in which x has coefficients considerably unequal; and by subtracting one from the other, ϵ is eliminated and x determined with tolerable accuracy. Finally, the substitution of these values of c and x in the original equations will give a satisfactory clock-error if the observations are good and pretty numerous, even although the observer has not more than 50° of clear sky to work upon. The times of transit of other objects must be corrected by the quantities thus found, and in this way apparent right ascensions may be deduced with considerable certainty.

The clock correction should evidently come out the same in both positions of the instrument, and the differences from the mean fall within the ordinary errors of observation. If this is not the case, and there should be reason to fear any alteration in the position of the stand or the Y's in the process of reversing, the values of x cannot be assumed to be the same in both groups. If the time should be required with extreme accuracy from such imperfect observations, the observer may alter the quantity of collimation in his calculation till he does get the same clock-error, although with different deviations, from both sets. This may be done by one or two trials, but generally speaking the mean of the clock-errors from both sets will be near enough, and not differ sensibly from the more elaborate calculation. It is not however easy to get the time *very satisfactorily* without being able to see the pole, or at least the zenith.

In what precedes we have supposed the extreme case, *i. e.* that nothing is to be seen north of the zenith, and that x therefore has always the same sign. The intelligent reader will be guided in practice, not by the directions here given, but by the *value of the coefficients of his unknown quantities*, a discretion which some astronomers cannot or will not use.

It is always desirable that the value of the three transit corrections should be small (indeed the formulæ are not exact, when the errors are large), to save unnecessary trouble in multiplying. The method of measuring the inclination implies that you can rely on the scale of the level for the quantity measured, which is scarcely true when the amount exceeds a few seconds of space. The collimation error is easily brought within reasonable limits, if the observer has a micrometer, or can see any fixed object distinctly while he alters the screws. The azimuthal adjustment requires either an object of reference, which is always the case in principal observatories, or adjusting-screws of which the thread and value are known, but this can only give correct results when the load upon the Y is inconsiderable. Portable instruments, which are really carried about and stuck at times out of a window, ought to have the spring to the azimuth-screw such as has been described.

It is convenient that the clock should be a little slow and have a small losing rate, the corrections for error and rate are then additive: if the west end of the axis be the higher and the deviation to the east of the south, the correction for these errors will also be *additive* to the observed transits of the greater part of the stars observed.

In most cases, the determination of the absolute time at the place is wanted, and this cannot be got without the level or some equivalent which tells how far the instrument swerves from the zenith. But where it is merely required to observe in a meridian, as in observing for a catalogue, it is more expeditious to change the form of the corrections. The two factors $\frac{\cos(\phi-\delta)}{\cos\delta}\times$ inclinat. $+\frac{\sin(\phi-\delta)}{\cos\delta}\times$ deviation may be expressed by a correction of this form: $m+n\tan\delta$, where m and n are two constants to be determined by observation.* In this case the stars should be observed in zones, and when the sweeps are not near the pole, it is easier to destroy the error of collimation by adjustment very nearly than to allow for the error. The secant of declination varies very slowly, and may be considered as a constant for the whole sweep, within moderate limits, and for a small value of the collimation, which may easily be reduced to $0^{s}\cdot1$ at once. Suppose an observer to have this purpose: he observes a large set of stars nearly at the same declination, taking care to have as many standard stars as possible above and below the limits of his sweep, and it is proper to have several with contrary declinations. Now calling the observed times of transit s, s', &c., he forms the following equations with standard stars:—

$$s+m+n\tan\delta=a$$
$$s'+m+n\tan\delta'=a'$$

and so on. From these he composes two equations, one formed of all those in which $\tan\delta$ is positive and another in which $\tan\delta$ is negative, and which therefore may be represented thus:

$$\Sigma+m+n\mathrm{T}=\mathrm{A}.$$
$$\Sigma'+m-n\mathrm{T}'=\mathrm{A}'.$$

from which n is found $=\frac{(\mathrm{A}-\Sigma)-(\mathrm{A}'-\Sigma')}{\mathrm{T}+\mathrm{T}'}$.

Substituting this value of n in the mean of the two equations, we have the value of m, and that with great exactness, if the stars have been well selected, are pretty numerous, and have been tolerably observed. To reduce the transits of the other objects observed to apparent R. A. nothing more is required than to add $m+n\tan\delta$ to the observed transit, which, besides being a good deal shorter than the method previously described, only requires a table of natural tangents for computing the corrections.

If the observations are made on or near the pole, where the sec δ varies almost as rapidly as the tangent, a sensible error of collimation would mix itself up in the value of $\tan\delta$. If the pivots of the instrument are exactly equal, two series

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* This was the case with Römer, and the transit instrument was invented precisely for such a situation. See 'Basis Astronomiæ' cap. 8.

* If i be the inclination as given by the level and x the deviation, then expanding the numerators, the sum of the corrections

$$= - = \frac{i(\cos\phi.\cos\delta+\sin\phi.\sin\delta)+x(\sin\phi.\cos\delta-\cos\phi.\sin\delta)}{\cos\delta}$$

$$=i\cos\phi+x\sin\phi+(i\sin\phi-x\cos\phi)\tan\delta$$

which agrees with the formula given above, putting

$$m=\epsilon+i\cos\phi+x\sin\phi$$
$$n=i\sin\phi-x\cos\phi$$

The formula is easily deduced by drawing a figure and referring the transits to the meridian which cuts the equator at the same point as the circle described by the telescope.

might be observed in reversed positions of the axis, and as m and n would have the same value in each, while the sign of collimation changes, the determination of the latter would present no difficulty. We have used another plan, which in steady weather, when observations can be made on consecutive nights and in large masses, is perhaps the best for cataloguing. On the first night observe forty or fifty stars, consisting of all the standards which pass and those stars the places of which you wish to determine. These may now lie scattered all over the heavens, so far as the method is concerned. On the following evening reverse the instrument and observe the same stars. The first night, each observed star should be increased by $m+n \tan \delta + c \sec \delta$, while the second night the correction is $m'+n' \tan \delta - c \sec \delta$, the collimation being supposed (as is found to be the case) to be invariable in a well-made instrument, unless violence is used. Now if we add the observed transits of each star on the two nights together, and take a mean, the result requires a correction of $\frac{m+m'}{2}+\frac{n+n'}{2} \tan \delta$; and the collimation is eliminated. This new correction for the mean of the two nights is exactly of the same form as the original correction, call it $M+N \tan \delta$, and M and N are found by comparing the observed places of the standard stars with their known computed places, just as before. If the clock rate is sensible, the values of M, preceding and succeeding the mean of the standard stars, must receive a proportional correction, but it is easy to make the rate of a good clock so small that in ordinary circumstances this may be neglected. The rate may be determined near enough by observing the same high star both nights in the same position of the axis and measuring the inclination by the level. From some trials of this method, we should strongly recommend it in a steady climate and where a large catalogue of stars is to be formed. An error of $0^{s}\cdot 1$ would, we are convinced, be very rarely found in the R. A. of stars so determined within 40° of the equinoctial; the computations are very short and can scarcely be wrongly made, and there is only one computation of a mean place for two complete observations of an apparent place. Writing the separate results under each other, is an excellent check against those provoking small errors which, when they once get admittance, are so difficult of detection. It is a drawback that the computation does not furnish the absolute time or clock error, if that should be required for other purposes, without further calculation.

In this climate it frequently happens that the star is visible during only a portion of its passage over the wires, or the observer may lose some of the wires; hence it is necessary to have some means of completing the imperfect transits, and ascertaining so far as possible at what time the star would have passed the *mean* of the wires, if all could have been observed. For this purpose a sufficient number of complete and satisfactory observations is selected (suppose the illuminated end to be west), and the difference taken between each wire, and the mean of the wires. Multiplying these numbers respectively by the cosine of the corresponding star's declination, we have the differences, such as they would have been if the stars observed had been in the equinoctial. A mean of these is taken for each difference, and the proper sign affixed. If a second series be selected of observations made when the illuminated end is east, and be treated similarly, nearly the same values will be found as before, but in reversed order, and with different signs. A mean is taken when the number is sufficient to give a satisfactory result; and the logarithms of the intervals between each wire and the mean, for an equinoctial star, are set down for future use, discriminating whether the instrument is Illuminated end E. or W. Now suppose a broken set of wires is to be made up: take the logarithms with the proper sign corresponding to each wire, add to each logarithm the log secant of the star's declination, and take the natural numbers corresponding to the logarithms thus found, and you have the number of seconds and decimals of a second which are to be *added* (algebraically) to the observation of each wire to reduce it to the mean wire. Of these partial results, a final mean is taken. The numbers for reducing each wire to the *mean wire* are found in the introductions to all the modern observations.

The slow-moving stars, such as Polaris and δ Ursæ Minoris, are those best suited for determining the interval of the wires, and this is one of the first points to which an observer should direct his attention, for he will observe a slow star as well at starting as afterwards, and as he will probably make a good many broken transits, the sooner he acquires the means of reducing them the better. The declination of these stars is perfectly known for every day from the Nautical Almanac, but there is a precaution to be taken here, which is unnecessary with quick-moving stars, as the path of the star being sensibly curved in moving from the outer to the inner wires, the motion between the wires is not uniform. The exact formula is

sin distance of any wire from mean = sin time from mean
× cos. declin. star;

and the equatorial interval may be computed by taking the log sin of the intervals – log sin 15″, instead of simply the log interval in seconds of time, as in other stars. Or if the following quantities be first subtracted from the intervals observed, the ordinary rule may be followed :—

Interval Observed.	Correction.	Interval Observed.	Correction.
4^{m} . . .	$0^{s}\cdot0$	21^{m} . . .	$1^{s}\cdot8$
8 . . .	0·1	22 . . .	2·0
12 . . .	0·3	23 . . .	2·3
13 . . .	0·4	24 . . .	2·6
14 . . .	0·5	25 . . .	2·9
15 . . .	0·6	26 . . .	3·3
16 . . .	0·8	27 . . .	3·7
17 . . .	0·9	28 . . .	4·2
18 . . .	1·1	29 . . .	4·6
19 . . .	1·3	30 . . .	5·1
20 . . .	1·5		

This table may also be used when the broken wires of a close circumpolar are to be reduced. Compute the correction for each wire by the ordinary formula, and add to it the number from this table corresponding to the interval, before applying the correction to the observation of the wire.

As the stars *sub polo* pass the wires in a contrary direction, the numbers for reducing each star to the mean wire must be taken from the table corresponding to the reversed position of the instrument, or, what comes to the same thing, they must be reckoned backward with changed signs from the table which belongs to the existing position. When the interval between the mean wire and the other wires is well established, the collimation error must be referred to the *mean* wire after it has been measured for the *middle* wire. There is a way of measuring the collimation, when the distance of each wire from the mean is well determined, which is very useful in the absence of a meridian or collimating mark. Polaris or δ Ursæ Minoris, or any slow-moving star, is observed over the first four wires (the inclination error having been previously measured); the instrument is then reversed and the star is observed over the remaining three wires, and the inclination again measured. The first set of observations is reduced to the *mean* wire by the known intervals at the horizontal position of the axis. The second set is similarly reduced to the mean wire, at the horizontal position. The difference between the two results, if the Y's have not been altered by lifting the instrument and setting it down again, is the sum of the collimation in two positions; and when this is divided by twice the secant of the star's declination, the result is the collimation error required. If the pivots are perfectly equal, the levelling may be omitted except as a precaution against altering the Y's. When the time is wanted with great nicety, it is convenient to observe a series of stars before reversing upon Polaris or δ Ursæ Minoris, and a second series after. If the pole star has been properly observed and reduced, and the collimation rightly determined, the two series will give nearly the same clock-error, and be a check on each other. The instrument must always be used in reversed positions, for determining the time, when this is practicable.

There is a curious anomaly sometimes found in transit observations, viz. that two practised observers will make a notable and constant difference in observing the exact moment at which a star passes a wire. Maskelyne first noticed this singularity in his assistant Kinnebrook, who observed a star $0^{s}\cdot7$ later than the Astronomer Royal. Bessel and Argelander have a still larger difference; and we found, on determining the longitude of Bruxelles chronometrically, that M. Quetelet, the director of that observatory, noted a transit about $0^{s}\cdot8$ earlier than Mr. Henry, one of the transit observers at Greenwich: so that if the time at each place had been simply taken from their observations without any allowance, the longitude would have been erroneous on that account *alone* $0^s\cdot8$, which might have been either way. This shows how insecure all nice chronometrical longitudes are, unless the same observer determines the time at both ends of the arc, or unless the relative *personal equation* of the observers at each end is carefully determined. It would be advisable perhaps, where the result is very important and the distance considerable, to *reverse* the observers, as it seems that fatigue will, in some cases at least, cause a variation in the personal equation, and that two observers may begin a night with one difference and end with another.

If it were not for this latter circumstance, it would perhaps be possible to train observers to observe alike, by exhibiting the same phenomena of sound and sight (the relation between which might be established mechanically) to a class, and habituating them, like an orchestra, to keep the same time; and such a piece of mechanism would be easily made, though there would be a difficulty in getting observers to submit to the drill. We have found the following practice a good exercise for making the eye and ear work together. The pointer of a clock, with dead-beat scapement, springs forward simultaneously with the sound of the beat. Where there is a good deal of noise, and the clock has a low beat, it is found necessary to have a second clock called a journeyman, which strikes loudly and speaks as it were for the transit clock. The observer makes them beat pretty nearly together, and then listening at the principal clock and noting the difference, he either pushes forward or delays the pendulum of the journeyman to make the coincidence perfect, and this ought to be continued until he cannot distinguish between the two beats when standing close to the transit clock. Let a person try to make this coincidence by *looking* at the transit clock and *listening* to the journeyman, and if he can, or can very nearly do this, it is evident that he notes an appearance at the time it happens. Perhaps by trying the same thing when fatigued, he might detect a change in his perceptions, for the coincidence of sounds, as judged of when equalized by standing near the weaker source, is one in which a tolerable ear can scarcely be more than $0^s\cdot01$ or $0^s\cdot02$ out at farthest.

The position of the horizontal axis has been all along supposed to be measured by the level, and this is certainly the most ready method. But the level may happen to be broken, or, unless it comes from a very careful maker, it may be sluggish, or unequally divided. The beautiful levels which accompany Ertel's instruments, which are covered at the ends with parchment and filled with æther, are very liable to leak, as we know by experience. In such a difficulty, our celebrated surveyor Captain W. F. Owen raised a tall pole, and having put thereupon a distinct mark, adjusted his instrument by moving the elevation screw until the wire passed through the mark seen directly and by reflexion. In another instance, where the level was broken, an observer of some name was unable to supply its place, and a projected set of observations failed in consequence. The simplest method is that pursued by Captain Owen, substituting the pole star or other slow-moving star at its culmination for the tall pole. When the axis is thus *nearly* corrected, which may easily be done when the star passes the first wire, it is better to observe the star over the rest of the wires half directly and half by reflexion, and to reduce each set to the mean wire. On drawing the figure it will be seen that any error of level will affect the transit of a star seen directly one way, just as much as it will affect the transit of the same star, seen by reflexion, the other way, or that the difference of the two transits, after each set has been reduced to the mean wire, is twice the error due to inclination: that is, the difference of the transits in the two positions is, when the star is above the pole, $= \frac{2\cos(\phi-\delta)}{\cos\delta} \times i$, from which i is determined, and may be used for all the other observations. The observation will succeed very well with any slow-moving star, if the observer has time to shift from one position to the other without hurry; or he may use two high stars, each observed over all the wires, if they have the same altitude, or if he should happen to know the other errors of his instrument. Indeed, if he has no objection to solve simple equations with four unknown quantities, he may proceed exactly as we have shown in former instances, introducing another term with i and its coefficient, and changing the sign for the observations by reflexion.

Observations by reflexion of Polaris are well suited for another purpose, viz. for examining the value of the level scale by means proper to the instrument itself. Raise the west end until the bubble is nearly at the west end of the scale, and by a mean of half a dozen readings, reversing each time, ascertain the error of inclination. Now observe Polaris exactly as we have before mentioned, or, if the observer likes better, directly over the 1st, 2nd, 6th, and 7th wires, and by reflexion over the 3rd, 4th, and 5th; reduce each set to the mean wire, and calculate by the formula already given the true inclination of the axis. On a following night repeat the operation, the illuminated end being on the same pier, only lowering the west end of the axis until the bubble is nearly at the east end of the scale, and get as before two values for the inclination, one from the scale, and another by observation. Take a mean, and you will have the true value of the parts of the scale. If the result varies much in the two experiments, it shows either that the curvature of the level is unequal, or that one pivot is thicker than the other. This may be ascertained by the level alone as we have shown above, or would be indicated by a difference between the direct and reflected observations when the axis is horizontal by the level, or by comparing the inclination obtained from reflexion in the manner last pointed out, in reversed positions of the instrument, supposing the Y's not to change during the experiment. Thus if the inclination be determined by observing Polaris over the first half of the wires directly and the second half by reflexion, a value of the inclination will be found. Reverse the instrument, and make the same observations upon another slow-moving star, and you will have a second value of the inclination, which should agree with the former if the pivots are equal; half the difference, if it exists, is the difference in the radii of the pivots. The level however affords a much easier, and, we believe, better measure of inequality; but it will not show if the pivots be elliptic, which the observations by reflection would do if stars [illegible] different altitudes were observed. If the two tests agree, it is a reason for believing that the pivots are round within the limits of these very searching experiments. But as we believe these observations have never yet been made, it would be useless to expatiate further upon their possible advantages. The late astronomer royal, Mr. Pond, tested the transit at Greenwich by observing a set of stars directly and a second set by reflexion after the axis had been most carefully levelled, and found that on reversing his sets on a subsequent night he got the same mean interval, as he ought. Professor Woodhouse examined his level scale by observing Polaris over half the wires with one end high, and the other half with the other end high. This is less sensitive than the method we have pointed out, but will do for its purpose very well, if the instrument is examined and verified by a meridian mark between the first and second set of observations, otherwise we should be afraid a change in azimuth might be caused by turning the elevating screw, in spite of all the care of the artist to prevent it.

An eyepiece has been introduced into use within the last few years, which, by illuminating the wires in a particular manner, enables the observer, looking downwards into a basin of mercury, to see at the same time the wires and their reflected image: if these be made to coincide, the telescope is vertical, and therefore the axis horizontal. If the micrometer wire be used to measure the interval, the result will be found to be twice the inclination.

The transit may be levelled, as it was in older times, by a plumb-line, which, hanging from a frame placed close to the instrument and in front of it, is made to pass over two dots, placed at the eye and object end of the telescope. This is an accurate but intolerably troublesome method. In Groombridge's circle, Troughton used a plumb-line in a tube at right angles to the axis and to the telescope for the same object. The images of the opposite dots at top and bottom were thrown on the line by lenses, and viewed through microscopes, in the way in which he always applied the plumb-line. We do not know whether Mr. Groombridge adjusted the horizontal axis by means of this plumb-line or no, but the artist himself said that he introduced the tube principally to make the axis equally weak all round, finding that it was previously so much stronger in one direction than another as to give him trouble in dividing it. Finally, the axis may be adjusted, or the inclination measured micrometrically by means of a vertical collimator, which is convenient enough, but, so far as our own experience goes, rather uncertain in its indications, and much inferior in *both respects* to a good level. A really good level carefully and frequently applied will show the position of the transit axis to about $0''\cdot2$ or $0''\cdot3$, or the inclination correction to $0^s\cdot02$, and this is a smaller quantity than a considerable number of careful observations will show.

From what we have already said, it is evident that where exact time is wanted, the collimation, inclination, and deviation factors are perpetually required. The collimation factor is merely a table of secants of declination, and may be taken from any table of natural secants. The inclination and deviation factors should be computed for each observatory to every 10′ of declination, and be tabulated for constant use. For the stars often observed, we find it most convenient to have a catalogue in which the log secants of declination, the natural secants and tangents of declination, and the factors for inclination and deviation, are entered in parallel columns with the proper signs. The astronomer royal employs a sliding-rule for these and similar computations. In computing this table for a given latitude, the formulæ will be advantageously transformed thus:—

$$\text{Inclination factor} = \frac{\cos(\phi-\delta)}{\cos\delta} = \cos\phi + \sin\phi\tan\delta\,;$$

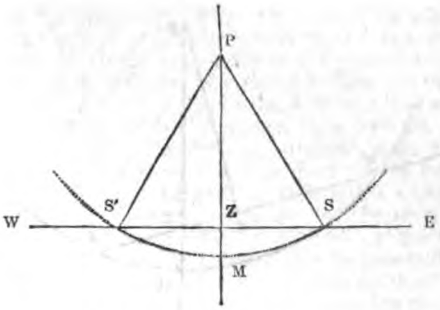
$$\text{Deviation factor} = \frac{\sin(\phi-\delta)}{\cos\delta} = \sin\phi - \cos\phi\tan\delta:$$

so that having the natural sine and cosine of latitude, and also the log sine and cosine, the computation reduces itself to adding the log tan. declination to these last. The necessary tables may be computed in a few hours as far as is advisable; for near the pole the change of declination has so large an effect, that it is necessary to use the exact declination.

Great service would be done to amateur practical astronomers by a judicious set of printed forms, in which to enter and reduce their observations; and by a set of tables sufficient for these small computations, and not containing anything further. This can only be obtained by repeated attempts, and after all, most observers would probably prefer a modification of some form, to adopting it implicitly. We have tried to produce something in this way on which a better attempt may be founded. The astronomer royal has published a portion of the forms used at Greenwich in the last volume of the Observations (1840), and we venture to recommend his practice to other observers, in order that their less able brethren may profit by their superior skill and experience.

While he was employed in the Royal Observatory of Paris, Römer proposed a method of determining the equinox by observing the azimuth of the sun at rising and setting near the time of the equinox, which method he illustrated by an example. (*Basis Astronomiæ*, p. 107.) He thus got rid of the effects of parallax and refraction, and deduced an accurate declination of the sun without an exact knowledge of the latitude. The method is a very good one, though undoubtedly inferior to that proposed and executed by Flamsteed. Many years after, Römer, on erecting a small observatory in his own country, placed a transit east and west, *i. e.* in the prime vertical. Almost all his papers were destroyed by a great fire at Copenhagen, and it does not seem by Horrebow's account that any use was made of this prime vertical transit. He intended probably to observe the sun in the prime vertical for the purpose already explained; but as he had now a meridian transit circle, with which he could measure declinations with great accuracy, he seems not to have followed up this idea. Bessel, in the 'Astronomische Nachrichten,' vol. ii., p. 9, showed that the transits of stars over the prime vertical near the zenith might be employed for determining differences of latitude with great accuracy; and since that time several observatories abroad have had transits erected in this position. We shall here briefly show how terrestrial latitudes and differences of latitude may be determined by a transit in the prime vertical.

Let P be the pole, Z the zenith, EZW the prime vertical, which is also the line described in the heavens by the transit, and SMS′ part of the daily parallel of a star which passes south of the zenith and near to it. Then if the time at which the star is on the wire at S and S′ be noted, the angle SPS′ is the difference of those times, and therefore known.



In the right-angled triangle ZPS,

$$\tan PZ = \tan PS \times \cos SPZ\,;$$

$$\text{or, } \operatorname{cotan}\phi = \operatorname{cotan}\delta \times \cos \tfrac{1}{2}\,\text{time elapsed.}$$

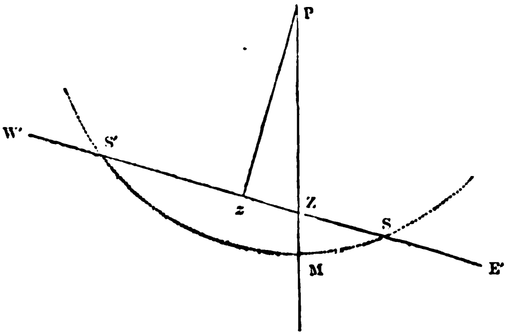
If then the declination of the star is known, the latitude is found; or if the same star be observed at two places, the difference of latitude may be found with only an approximate knowledge of its place.

Again, if the same star be observed regularly at the same place, as tan declination = tan latitude × cos ½ time elapsed, and as the time elapsed can be observed with the greatest nicety, the *variations* of declination can also be measured with great precision. Thus the constants of aberration and nutation may be determined by a transit in the prime vertical instead of a zenith sector, and we suppose some such application is contemplated for those which have been already set up. We think the advantage questionable. The telescope in a zenith sector may be of almost any size, which gives it an immense advantage over the transit. The level may be applied just as well to one instrument as the other (the plumb-line much better to the zenith sector); and though the division by time in the transit is more perfect than division by arc in the sector, the telescopes being of the same power, it is certain that the division is not the failing part of the sector. An error in the form of the pivots would be injurious to the transit, and is not readily to be detected; but of little consequence in the sector, and easily detected. It must however be admitted, in returning from this digression, that the zenith sector has not as yet quite equalled the expectations which might be formed of it; and that the modern transit, as it comes from the best makers, is an almost perfect instrument.

In determining the latitude by the portable transit, it is easy to place the instrument with sufficient accuracy, for the error must be considerable to affect the result very sensibly. An object-glass may be inserted in one pivot, and wires and an eye-piece into the other, and the telescope be directed upon a mark placed in the meridian by the instrument used in the ordinary way. This would possibly suit most observers best. Ertel of Münich (and many other continental artists) makes an astronomical theodolet, which is particularly adapted to this observation: the divided horizontal circle enables you to set the transit axis in the prime vertical; and as the telescope has a prism at the centre of the axis, to reflect the rays down the transit axis itself, the observer looks horizontally wherever the stars may be. It may be necessary to warn the unpractised observer that in this problem he only gets the *exact* latitude at once if the telescope passes through the zenith, or if the axis is truly horizontal. If the north end is high, for instance, 5″, the circle described by his instrument will pass 5″ to the south of the true zenith, and he will get by the formula given above an apparent colatitude too great by 5″.

If the axis is very incorrectly placed with respect to the meridian, the colatitude will be sensibly too small. Let the axis point to the east of the north; then the telescope describes a vertical circle passing through E′ZW and Pz, which bisects S S′, will be the colatitude which results from the formula.

If the true sidereal time be known with moderate accuracy, find how much the middle of the times of the star's transit over the supposed prime vertical, corrected for clock-error, differs from the time at which it actually passes the meridian, *i. e.* from its right ascension. This difference is the $\angle ZPz$, which is consequently known. Now from right-angled triangle PZz



$\tan.\ PZ.\ \cos.\ ZPz = \tan.\ Pz = \tan.\ PS \times \cos.\ \frac{1}{2}$ elapsed time;

$$\text{or, } \tan.\ \phi = \frac{\tan.\ \delta \times \cos.\ ZPz}{\cos.\ \frac{1}{2}\ \text{time elapsed}}.$$

It would be better to deduce the angle ZPz, which is the same for all stars, from a star which does not pass very near to the zenith, as the passage is more easily observed, but the length of time which elapses between the two passages of such a star is inconvenient. If the time is well known, one such passage will do.

If the observer has any means of determining the error in azimuth by a reference to known objects in the horizon, the correct latitude may be easily deduced from the approximate.

$$\text{Sin } PZ = \frac{\sin Pz}{\sin PZz}, \text{ or } \cos \text{lat} = \frac{\text{cos. approximate latitude.}}{\text{cos. of azimuthal error.}}$$

Lastly, as almost all transits have vertical circles, which are or may be tolerably adjusted, the observer may measure the apparent zenith distances, ZS and ZS′, pretty nearly, and half the difference gives Zz.

Then $\cos PZ = \cos Pz \times \cos Zz$, or sin latitude = sin approximate latitude × cos of half difference in star's altitude east and west.

By reversing the instrument, any error of collimation or inequality of pivots will produce exactly a contrary effect on the latitude. Observations therefore of two stars on the same day in reversed positions, or of the same star on following days in reversed positions, will correct each other, and the mean will give the true latitude, *i.e.* as nearly as the declination of the star is known. We have dwelt the longer and more minutely on this problem, because where great accuracy is required with but moderate means, it would seem that this is the best method of determining the latitude, and is therefore especially suited to coast surveying. It has been extensively used in the Russian navy, and by many travellers, German and Russian. There is one caution which the users of this method must not disregard, and that is, that the position of the instrument be so stable that no motion of theirs while observing can affect the horizontality of the axis. With this precaution, and such transits as are turned out of the best workshops here and abroad, a thirty-inch instrument will give, we conceive, the latitude within 1″ or 2″, without any particular skill on the part of the observer.

There is one word more to be said on the subject of pivots before concluding. By the mode in which they are turned and finished, they ought to be true cylinders, having their axes in the same right line; and so, no doubt, they are, very nearly, when the axis is strong and the pivots are turned in a good lathe, using a diamond for steel pivots. A little inequality of radius we have shown how to measure and correct for. But if the pivots are elliptical, the fault will not be shown by the level; and its effect will be to give the instrument a small variable error in azimuth, the period of which is 90°. There are several ways of trying whether the pivots have a correct form, but the error is so small as not to offer much hold to any direct method; and yet, if it does exist, no mass of observations will have any tendency to get rid of it. Reversion gives a chance of compensating the error in part; and we think the plan of rendering the object and eye end interchangeable is worth considering with a view to correcting such an error, at least in small instruments.

The right ascension of the standard fixed stars, as they are published by the principal observatories, do not in all instances agree as closely as might be expected from the mass of observations and the apparent accuracy of each. Whether this can be accounted for by supposing each catalogue to have a small variable error depending on the flexure of the axis of the instrument, or an error in the form of the pivots, is more than we can undertake to say; but it is a matter well worthy of investigation in the present state of practical astronomy.

We have deferred our account of the *Astronomical Observatory* until the principal instruments which form its furniture were described. We cannot attempt such a minute delineation as would suffice to guide any one who wished to erect such a building. It will be enough to state some of the properties which a well-contrived observatory should possess, and this may help an intelligent person to form a judgment after examining several of those which exist.

An observatory, as was well remarked by **Römer**, is nothing more than a covering for the instruments and a protection for the observer from the inclemencies of the weather. This should be steadily borne in mind by an architect who is called upon to furnish a plan for such a building, especially if he be limited in cost. The best situation is a gentle eminence which commands an uninterrupted view of the horizon, but which should not be abrupt or very high. The observatory at Cambridge is nearly perfect in this respect. The best foundation is undoubtedly rock; the foundation must be solid enough not to change rapidly. Absolute immoveability is not to be obtained. The supports of all instruments which are carefully watched show slow movements depending either on temperature or moisture, or some causes which are more obscure.* No rule can be given as to the depth at which the foundations of the piers supporting the instruments should be laid. The deeper, broader, and more solid the better. The outer earth should not touch the base below the surface, and the outer walls should stand quite freely from it. The floor should be quite clear of a pier or its foundations. With these precautions the change of position in the instruments will be very slow, and when it is slow and uniform the effect is easily taken into account. In some of the earlier observatories, the instruments are placed high above the ground, and in several of the Italian and some Continental observatories they are at the summits of lofty towers. We need not say that any elevation beyond that which is required to command the horizon and keep the building dry and well ventilated is injurious. If distant meridian marks can be erected to the N. and S. it is of advantage, but this condition is not essential.

The instruments which are required for an observatory depend of course upon the class of observations which are to be pursued there. It has been too much the custom to build observatories nearly alike and to pursue exactly the same objects. We shall mention those instruments in order which may be considered important enough to give the name of observatory to their enveloping buildings.

The *transit* and its *clock*. These, on some scale or other, are required by almost every observer, as the time enters nearly into every observation, and a transit is the best instrument for getting it, and a good well-fixed clock is wanted for keeping the time when got. In principal observatories the transit is generally from five to ten feet focal length. We think the latter size unnecessarily large for the objects usually observed, and faint objects which require light, and consequently a telescope of large aperture, might be turned over to the large equatorial and micrometer. A five-foot transit with an object-glass of the best quality will show everything that is usually observed, as well as the largest instrument, and is much more manageable. It can be levelled by one person with a hanging level and reversed by hand. The time can be got to the tenth of a second by a 45-inch or by a 30-inch transit, if they are of the *best* kind and well handled, so that these are sufficient for the most delicate determination of time. The larger transits are necessarily supported between two stone pillars, and we strongly recommend that the smaller transits should also be so mounted, when practicable, and on a sound and detached foundation. The clock is firmly fixed to its own insulated pier, or against a solid wall where there is not room or convenience for a separate ier. The best situation is with its face looking towards the bserver when he is looking south, and so that the observing hair is not likely to strike it. The windows should be on he north side of the transit and circle rooms.

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* The Astronomer Royal, when at Cambridge, noted a yearly oscillation of level in his transit-piers. Professor Henderson at Edinburgh finds heat affect his transit so regularly, that he can predict his error level from the reading of the underground thermometer.

The *meridian circle*, which, in England at least, is always mural circle, and, so far as we know, there has been itherto no material improvement in the plan first followed y its inventor, Troughton. Perhaps if the circle were cast one piece, the whole would be firmer. The standard size f the mural circle is 6 feet, but it has been made of 8, of , and of 4 feet. The transit and circle require two bservers, and consequently separate apartments, as the ransit observer while counting the clock would be disurbed by any noise. Where two observers cannot be fforded, a *transit circle* may be made to answer both puroses, and such are used, in preference it would seem, in he German, Russian, and Italian observatories.

The transit, meridian circle, and clock are the instruents on which exact astronomy is founded, and they iffer from other astronomical instruments in the observaory they require. This should be for each a square or blong room, from 14 to 20 feet in its smallest direction, iz. north to south, and 10 or 14 feet high, with a slit of rom 18 to 30 inches wide, cut in the direction of the eridian through the roof and side-walls, to about six nches below the height of the centre of the telescope. s this must be open during observation, it must be losed to exclude the weather by shutters easily removed. f the building is not very large, the vertical slits may be ecured by a shutter in one or two pieces, and the top by ne or more shutters turning on a hinge, pretty much like box-lid, in a way that any good carpenter will undertand.* A specimen of what appears to us a very good undamental observatory is the working part of that t Oxford, consisting of two square rooms like those lescribed, separated by a small waiting-room between hem and by an entrance. The slits in larger rooms may e closed by shutters which slide back and forwards by ulling the ropes attached to them. The shutters, where he opening is wide, are in halves, meeting in the middle. This is the Greenwich shutter: at Brussels the shutters re in one piece. At Cambridge the shutters are double, s at Greenwich, and the ropes connected with both sides re drawn simultaneously and either way by turning a winch. These were very expensive, and are or were troublesome o keep in order; but whatever be the plan of the shuters, the opening must be wide enough to let the air within nd without the building come to the same temperature very nearly. A telescope never performs well *optically* which peeps through a narrow slit, and the refraction must always be uncertain where the temperature of the air varies rapidly and irregularly.

The next instrument is the *equatorial*, which, when it is used for exact measurement depending upon the graduated circles, should scarcely have a larger telescope than one of five feet, with circles of from two to three feet diameter. Such an equatorial is intended at times to supply the place of the meridian instruments when the phenomenon observed is not visible on the meridian, and yet where the observations cannot be confined within the limits of the micrometer. The equatorial is necessarily an indifferent instrument, except used differentially; and in this case, the immoveability of the foundation is of less importance than the extent of the horizon. It is generally raised high enough to overlook the circle and transit rooms, and has a revolving roof with a slit on one side, which thus gives a command over the entire heavens. If an observer wishes for one instrument which will make good observations in any part of the heavens, he must confine himself to the *altitude* and *azimuth circle* under a revolving dome; but though everything may be done with this instrument, it must be admitted that it is with considerable expense of thought and calculation.

To be able to pursue some of the most interesting departments of modern astronomy, an observer must possess a telescope of large size, equatorially mounted, and carried by clock-work. This is especially designed for making all micrometrical observations, as those of double stars, diameters of planets, &c., and requires a graduated circle only for finding or identifying objects. Such an instrument is the superb telescope presented by the Duke of Northumberland to the Cambridge Observatory, which was mounted entirely on the plan of the astronomer royal.* Instruments of this class are almost necessarily on the ground, and may be in an isolated building, if a better horizon can be thus commanded. It is not a simple thing to construct a rotatory roof of 25 or 30 feet diameter, light enough to be easily moved, and yet of sufficient strength, since it must necessarily have a slit on one side from top to bottom. The astronomer royal adopted at Cambridge a Chinese-looking form, viz. a flatter cone on the frustrum of a sharper cone. There is a flattish channel on the top of the circular wall, in which half a dozen cannon-balls are laid at equal distances, and thè roof rests on them, with another channel in its curb. This appears to be the cheapest, easiest, and most certain mode of getting a rotatory roof, but there is a good deal of rolling. The conical form is of much simpler construction than the spherical, and the shutters can be better applied to it; but in appearance the spherical form has greatly the advantage of any other form. For measuring objects which do not require a large field, the astronomer royal has applied a divided eye-piece, which seems to answer very well; but we do not know whether a careful series of measurements has been made with that and the usual micrometer, to test their relative merits. Both are very limited as to the extent of angle they can measure; and where it is proposed to make most accurate measurements of angles, which may extend to 1°, the proper instrument is the *heliometer*, or equatorial with a divided object-glass. It is with this last-mentioned instrument that Bessel has succeeded in establishing the existence of parallax, which had baffled astronomers ever since the existence of parallax was proposed as a test of the motion of the earth. A heliometer has been ordered for the observatory of Oxford, but it will be some time before it can be finished.

Some years ago we should have been disposed to rank the zenith sector, or zenith tube, among the principal requisites of an observatory. Hitherto the results given by the zenith tube at Greenwich have not been such as to realise the high expectations which were held of the instrument, but it is still in a progressive course of improvement.

Lastly, if it is wished to cultivate that department of astronomy which we will call the *Herschelian*, an observatory must be furnished with gigantic reflectors, as it seems hopeless at present to expect that refractors can be made large enough to transmit sufficient light. These instruments however must almost of necessity be used in the open air.

A private astronomer would probably do most to advance the science by confining himself chiefly to extra-meridian observations, which may be taken up and left off at pleasure. A small transit for time, and as large an equatorial telescope as he can afford to set up, would be sufficient to employ his leisure very profitably.

An observatory is a very dull and uninteresting sight to any one who is not acquainted with the purposes to which it is applied; and we can scarcely conceive how Lalande could say, or others repeat after him, that a person would learn more of astronomy in one night in an observatory than in six months elsewhere. We should say there was no worse school; and that a person would learn astronomy far better from a celestial globe and a fine sky. It is probable however that Lalande supposed his learner to possess some elementary knowledge, and to be acquainted with the geometrical part of astronomy; in which case he would, no doubt, learn that in an observatory which is not to be learned or understood elsewhere.

There is no perfect model of an observatory, as respects the building, to which we can refer. Cambridge is perhaps the best, but on a larger scale than is necessary. We have already mentioned Oxford; Greenwich has nothing to recommend it as a building, but the goodness of the instruments, and the number and methodical arrangement of the observations and computations may be judged of from the printed Observations.†

If an architect should have to construct a first-rate observatory, we should advise him, after learning what instruments are to be accommodated, to study each of these observatories, and arrange the rooms in the most convenient manner. The best appearance which the case admits of may be given afterwards, but he should not be very rigorous as to outside symmetry. It is scarcely possible to unite convenience as an observatory with a regular exterior, except at a considerable expense.

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* The workmanship of the shutters, especially the roof-shutters, should be very sound, and the laps bold, or they will not continue water-tight.

* A description of this instrument will shortly be published.

† The Royal Observatory is only to be seen by the public at stated hours, and by leave from the lords of the admiralty. It is found necessary to adhere very strictly to this rule in the immediate vicinity of London, or a lounge over the Observatory might soon become a usual preparation for a whitebait dinner. We had prepared a plan of the buildings which form the working part of the Observatory, but it is so rambling and inconvenient, that it is not worth publishing here.

We will conclude with a few remarks, which are perhaps self-evident, but which nevertheless seem to have escaped the attention of some of those who have founded observatories. It is not enough that a splendid building is filled with magnificent instruments directed by a consummate astronomer; he must have at his disposal numerous subordinate assistants for observation and computation, and funds for printing the observations and results. At present Greenwich is almost the only observatory which is tolerably manned; and even Greenwich is under-handed for *fundamental observations*. These require that the state of the clock, of the transit, and of the circle should be known at all times, in order that every other observation may be available. Now this alone nearly absorbs the time of two assistants, and gives just the same trouble whether many or few additional observations are made. If we are correct in this view, an observatory of this class produces new matter almost in proportion to the observers above two. Without insisting very strictly on the exactness of this rule, we say confidently, that an additional assistant at Greenwich, Cambridge, Edinburgh, or Oxford, would do more good than two better men in a new observatory. What is wanted is greater force in all these observatories, if they are expected to keep up their present volumes of observations; or the consequence will necessarily be, that being tasked beyond their strength, they must give in from weariness or sickness. It is only in the English observatories, and since the astronomer royal set the example at Cambridge, that all the observations are completely reduced and published within a short time of their being made; and yet, without this publication and reduction, what is the use of an observatory?*

TRANSITION ROCKS. When the general terms 'Primitive' and 'Secondary' were much in use among geologists, certain assemblages of rocks, which were of intermediate position, and seemed to unite the mineral aspect of the 'Primitive' with the organic enrichments of the 'Secondary,' were for these reasons called 'Transition Gebirge,' 'Roches de Transition,' and 'Transition Rocks.' The term was very extensively used by the pupils of Werner, and maintained, till within a few years, an important place in geological nomenclature.

By the progress of sound observation this classification has been disturbed: the rocks of fusion have been separated from those of aqueous deposition, and thus the original classes of primitive and secondary rocks thrown into new and more appropriate groups; the investigations into antient organic life have introduced the 'tertiary' strata, and demonstrated that, from the earliest marine depositions to the actual sea-bed, a continual succession of 'transitions,' a series of gradations only locally interrupted, unites into one general history all the deposits from water, as a parallel series of inquiries has associated the products of heat. It is therefore no longer convenient to give exclusively to the gradations which happen among the earliest rocks a title which is equally applicable to all other parts of the series of strata; and the term 'transition' is now almost extinct as designating a class of rocks, and is replaced in nomenclature by other terms.

Some of these are founded on the general idea of *successive superposition* among the strata. Thus we have, from Mr. Conybeare, the

Superior Supermedial Medial Submedial Inferior	Orders of strata.

Again we have the strata distributed in 'systems,' on the *combined principles* of successive superposition, mineral constitution, and organic contents. Hence the

Cretaceous Neocomian Oolitic Poikilitic Carboniferous	Systems of secondary strata of various writers.
Devonian Silurian Cambrian	Systems of primary strata of Murchison and Sedgwick.

Mr. Lyell's classification of tertiary strata into

Pleiocene Meiocene Eocene	Periods,

is based on considerations of the affinities of tertiary and existing forms of organic life.

Finally, we have proposed in this work [PALÆOZOIC SERIES] a general scheme, founded purely on the *succession of organic life* observable in the stratified rocks. Hence the

Upper Middle Lower	Cainozoic rocks.
Upper Middle Lower	Mesozoic rocks.
Upper Middle Lower	Palæozoic rocks.

Undoubtedly the student may regret the variety of classifications (of which we give only these specimens) prevalent in geology: yet it is probably for the true interest of this branch of inductive science that all the leading generalizations now established as a basis of sound theory should be represented in our nomenclature, not by confounding them together, and thus destroying their physical meaning, but by separately developing them as exponents of separate branches of one great method of approximating to the history of the successive conditions of the globe.

TRANSITS OF MERCURY AND VENUS. The inferior planets, as they are called, whose orbits are within that of the earth, may sometimes appear to pass over the body of the sun, eclipsing by their opacity successive parts of the solar surface. The transits of Mercury and Venus are phenomena of this kind. They do not take place very often, as they can only be when the planet is in or very near to the node of its orbit, at the time when a line drawn through the sun's centre and that node passes through the earth. As the nodes of the planets alter their positions on the ecliptic very slowly, it will happen for many centuries together that these appearances can only take place at stated periods of the year in which they happen: a transit of Mercury is always either in May or November (according to the node of the orbit at which it takes place), and one of Venus in June or December. The first transit of Mercury which was observed took place in 1631, and of Venus in 1639, and the following are the dates of those which have occurred since, or will occur for a long time to come:—

Transits of Mercury.

Nov. 6, 1631.	Nov. 10, 1736.	Nov. 11, 1815.
Nov. 8, 1644.	Nov. 2, 1740.	Nov. 4, 1822.
Nov. 2, 1651.	Nov. 4, 1743.	May 5, 1832.
May 3, 1661.	May 5, 1753.	Nov. 7, 1835.
Nov. 4, 1664.	Nov. 6, 1756.	May 8, 1845.
May 6, 1674.	Nov. 9, 1769.	Nov. 9, 1848.
Nov. 7, 1677.	Nov. 2, 1776.	Nov. 11, 1861.
Nov. 9, 1690.	Nov. 12, 1782.	Nov. 4, 1868.
Nov. 2, 1697.	May 3, 1786.	May 6, 1878.
May 5, 1707.	Nov. 5, 1789.	Nov. 7, 1881.
Nov. 6, 1710.	May 7, 1799.	May 9, 1891.
Nov. 9, 1723.	Nov. 8, 1802.	Nov. 10, 1894.

Of these the transits yet to come in 1845, 1848, 1861, 1868, 1878, will be visible (weather permitting) in this country.

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* The observations of the fixed stars, by Bradley, made eighty years ago, were of little use until they were reduced by Bessel (*Fundamenta Astronomiæ*). The observations of the planets by Bradley, Maskelyne, and Pond have only recently been reduced and brought into an available shape for the physical astronomer, under the superintendence of the astronomer royal. These are now in course of publication. The observations, for the same period, of the moon, the especial object for which the Royal Observatory was founded, are now reducing, and compared with Plana's theory, also under the gratuitous direction of the astronomer royal. The funds for these computations were furnished by the liberality of the Treasury.

Descriptions of the following amateur observatories are to be found in the 'Astronomical Society's Transactions:'—Capt. W. H. Smyth, R.N., vol. iv., p. 545; T. M'Clear, Esq., vol. vi., p. 147; W. Lassell, Esq., vol. xii., p. 265. See, too, Pearson's 'Practical Astronomy,' vol. ii., for 'Dome' and 'Transit.'

Transits of Venus.

Dec. 4, 1639.	Dec. 8, 1874.	June 7, 2004.
June 5, 1761.	Dec. 6, 1882.	June 5, 2012.
Juue 3, 1769.		

Of these the transits of 1882 and 2004 may be visible in his country.

The use of these transits is threefold. First, they may be employed in correcting the tables of the planet in quesion; secondly, in computing the longitude of the place of observation; thirdly, in finding the actual distances of he planet and of the sun from the earth. The first of the uses is shared by the transits with many other kinds of obervations, and as they occur so seldom, it is fortunate that n this respect they are by no means indispensable; and he same may be said of the second use. As to the third, he transits of Mercury, which occur with tolerable frequency, are comparatively useless, from the difficulty of he observation: but the transits of Venus are more available, and furnish our most precise mode of ascertaining the distance of the earth from the sun.

It cannot be shown *precisely* to any but a mathematician, how it is that the observation of a transit of Venus at everal different places on the earth's surface is made to nswer the above purpose. The phenomenon itself obviously resembles an eclipse of the sun [Sun, p. 282] as distinguished from one of the moon; and is affected in ts progress by the rotation of the earth. If a spectator were placed at the earth's centre, he would see Venus pass over a certain line on the sun's disk, traced out by a moving line the end of which is in his own eye, and which passes through the centre of Venus: whenever this line passes through the sun's surface, Venus will appear to be projected on that surface as a dark spot. At the same ime a spectator on the surface of the earth will refer the pot to a different point of the sun's surface, and the hing to be noted is, that the difference of the lines which Venus appears to pass over on the sun's surface depends jointly on the spectator's place and the positions of Venus and the sun. The formula by which the time of transit is connected with these two things, the specator's place, and the position of Venus and the sun, points out that the difference of the apparent beginnings and endings of the transit at different places on the earth's urface depends entirely on the difference of the distances of the sun and Venus from the earth (as is sufficiently evident without the formula; for if the planet were at the ame distance from us as the sun, that is, if it really passed over the body of the sun, the phenomena would not be ensibly different at any two parts of the earth). The distances of the sun and planet enter into the formulæ by means of their parallaxes [Parallax]; and if the difference of the parallaxes is once known, the parallaxes themselves are known, for the proportion of the distances of the earth and Venus from the sun is sufficiently well ascertained from Kepler's laws. At a place of known longitude, if only the ingress or egress of the planet be observed, either of the two, and if the phenomenon can be calculated as it would be seen from the centre of the earth, then the difference of the parallaxes can be found: but this supposes, first, that the longitude of the place is very well known; secondly, that the errors of the tables of the Sun and Venus are insensibly small. If both the beginning and ending of the transit can be observed at one place, it is no longer of any consequence that the longitude of the place should be so accurately known; an approximate determination of it will be sufficient: still the errors of the planetary tables remain. But if both beginning and ending of the transit can be observed at two different places (and the greater their difference of longitude the better), then the differences of the parallaxes can be computed from the two observed durations of the transit, independently both of the longitudes of the places and of the planetary tables, that is, so as not to be rendered sensibly inaccurate by any moderate inaccuracy in either. The fact is, that when the transit is observed at one place only, the formulæ suppose it to be known at some other, either the centre of the earth, or Greenwich or some other observatory. When the transit is observed at two places, the second observation is inserted instead of the computed substitute for observation. This explains why it was that expeditions were sent by different governments to different parts of the globe to observe the transits of 1761 and 1769. If the transit should be seen both at its beginning and ending at six different places, every pair of them (and there are 15 pairs) would give a determination of the difference of parallaxes, and the mean of all the results would be entitled to a high degree of confidence.

The first transit of Mercury that was ever observed was seen by Gassendi, November 6, 1631; the first transit of Venus by Horrocks, December 4, 1639. Halley pointed out the use of such transits, and preparation was made to observe that of 1761. Legentil was sent to India, Chappe to Tobolsk, and Pingré to the island of Rodriguez, by the French government; Maskelyne went to St. Helena, and Mason to the Cape of Good Hope (he intended, but was prevented, to go on to Sumatra). The weather hindered or injured most of the observations: the most fortunate was that of Mason, who made the sun's parallax eight seconds and a half. The transit of 1769 was still better attended to. The complete duration of the transit was observed at Cape Wardhus, Kola, Cajaneburg, O-taiti, Fort Prince of Wales on the north-west coast of Hudson's Bay, St. Joseph, and Santa Anna in California. The ingress of the planet was seen at almost all the observatories of Europe; the egress at Petersburg, Yakutsk, Manilla, Batavia, Pekin, Gurief, Orska, and Orenburg. The value of the parallax was variously deduced, different astronomers preferring different values, from 8″·5 to 8″·8: Laplace used 8″·66; M. Encke deduced 8″·5776 from all the observations. De Ferrer (*Mém. Astron. Soc.*, vol. v., p. 253), from a re-examination of the whole observations, deduces 8″·58, and thinks this cannot be wrong by so much as three-hundredths of a second.

Most of the observers who saw the ingress of the planet unite in stating that after the planet had entered on the sun, it continued for a short time to appear as if it were joined to the limb or border of the sun by a dark protuberance or ligament (some call it a thread). This phenomenon appears to be of the same sort as that noticed in Sun with respect to the annular eclipse. A full account of what was seen with respect to Venus will be found in Mr. Baily's paper there referred to. (*Mém. Astron. Soc.*, vol. x., p. 1.)

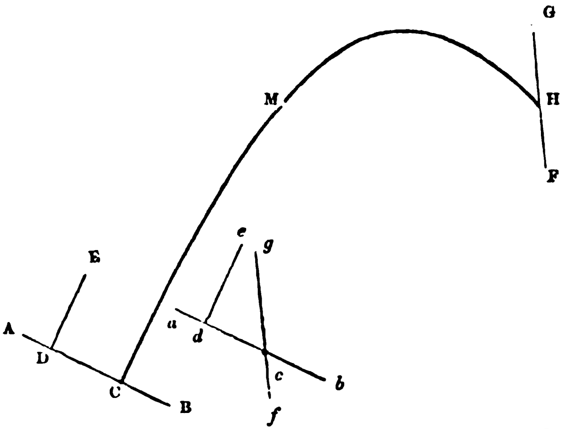
TRANSLATION. This word is used in mechanics, as distinguished from Rotation, in the following manner:—A body has motion of translation when all its points move in parallel straight lines; when, in fact, all its points have the same motion. If all have not the same motion, there is either simple rotation, that is, about one permanent axis; or rotation about a varying axis; or else a compound of translation and rotation. The motion of a single point must always be called translation, rotation being an inadmissible idea.

The point which is called the centre of gravity of a system, and which is of no small importance in the theory of equilibrium, has yet more in that of motion. The motion of any free system is compounded of the translation of its centre of gravity, and the rotation about an axis (whether always in one direction or not) passing through its centre of gravity. Now whatever the forces may be by which such a system is either set in motion, or acted on while in motion, the translation of its centre of gravity may always be made a distinct problem from the rotation about its centre of gravity, by the following simple rules:—

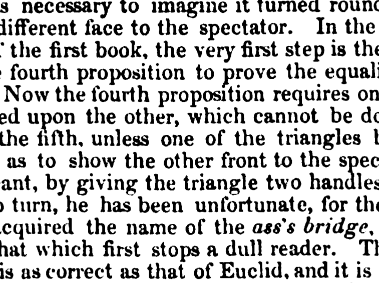
1. The centre of gravity moves just as it would do if the whole system were there collected, and all the forces were there applied.

2. The rotation of a system about its centre of gravity is no other than what it would be if that centre were made a fixed point, and all the forces applied in their proper places.

Suppose, for instance, a bar AB, whose centre of gravity is at C, is sent spinning into void space by a certain blow in the direction DE, communicated at D. Let there be another similar bar *a b*, whose centre of gravity *c* moves on a fixed pivot without friction, and which, being parallel to AB, is struck at the same instant with a similar blow in the direction *de*. To find the position of the bar at the end of any given time, say three seconds, is a twofold problem, as follows:—First suppose all the mass of the bar concentrated at C, and let the blow be struck, with the same force and direction, at the point C. This point C will then describe a certain parabola CMH; say that in three seconds it is at H. Next turn to the bar which moves on a fixed pivot, and let *f g* be its position in three seconds. Draw FG, a position of the bar parallel to fg, F being its centre of gravity, and FG will be the real position of the bar at the end of the given time, three seconds; and similarly for any other given time.



Thus much of translation, mechanically considered: we now speak of the wider use which the word has, or might have, in geometry; at any rate we have the thing to consider, and perhaps *transference* might be preferable to translation, as applied to the motion of a figure from one part of space to another. The conception of the possibility of figures differing only in position, and composed of perfectly equal and similar parts of space, similarly bounded, is one which is demanded of the beginner in geometry. Euclid requires this when he speaks of equal figures; and his test of equality, namely, the possibility of creating a perfect coincidence, requires the notion of one figure being transferred in any requisite manner, whether by what is called in mechanics translation, or by rotation, or both. It must be a sort of copy, or facsimile, of one part of space which is thus moved into and made to occupy another: for it is impossible to imagine *space removed*, or any part of *space* made to change place. And this copy, or whatever it may be, must have rigidity, that it may not change form by the way: it must be rigid in our thoughts, at least. We are thus required to imagine space endowed with some of the essential qualities of matter, before we can prove the fourth proposition of Euclid's first book: there must be the consistence of matter without its impenetrability, but whether it requires force and time to change place, or not, is of no consequence. Even a plane figure must be a sort of rigid consistence with two sides to it, for it is necessary to imagine it turned round, so as to present a different face to the spectator. In the fifth proposition of the first book, the very first step is the application of the fourth proposition to prove the equality of two triangles. Now the fourth proposition requires one triangle to be placed upon the other, which cannot be done in the figure of the fifth, unless one of the triangles be turned round, so as to show the other front to the spectator. If Euclid meant, by giving the triangle two handles, to make it easier to turn, he has been unfortunate, for the proposition has acquired the name of the *ass's bridge*, probably as being that which first stops a dull reader. The following proof is as correct as that of Euclid, and it is not much to say that those who do not understand it will not understand the one he gave.



Let ABC be an isosceles triangle, having AB=AC. Let it be turned round (for illustration, the dotted lines show the track of the three points, and two intermediate positions are shown) into the position DEF. Then in the two triangles ABC, DEF, we have AB=DE, for DE is AC (=AB by hypothesis) removed. Also AC=DF, for a similar reason. And the angle BAC= the angle EDF, the second being only the removal of the first. Hence we have AB=DE, AC=DF, and $\angle BAC = \angle EDF$, and now by the fourth proposition it follows that $\angle ABC = \angle DEF$. But $\angle DEF$ is only another position of $\angle ACB$: whence $\angle ABC = \angle ACB$, which was to be shown. If preferred the triangle ABC might be turned round upon itself, and the reasoning of the fourth proposition applied at once.

It is not to be supposed that Euclid did not see the preceding: but he is a writer who very rarely goes out of the most obvious path without some cogent reason connected with his system. The proof given above would not serve to demonstrate the equality of the external angles without the previous introduction of the properties of adjacent angles; and it happens that the knowledge of the equality of the external angles is immediately wanted.

TRANSLATION. [VERSION.]

TRANSMUTATION OF METALS. [ALCHEMY.]

TRANSPARENCY is that quality in certain substances or media, by which the rays of light incident upon their surfaces are allowed to pass through them. No substance can be said to be perfectly transparent, yet all bodies possess this quality in some degree: the most dense metals, as gold, if rendered very thin, will transmit light; and on the other hand, the quantity of light which passes through the most transparent media, as water or glass, becomes less, or the transparency diminishes, as the depth of the substance is greater.

It was at one time supposed that transparency results from the pores of a material being of such magnitude that the particles of light can pass through them in every direction without impinging upon the solid molecules of the body or medium; but this circumstance is not alone sufficient to account for the phenomena presented by diaphanous bodies.

Newton assumes (*Optices*, lib. ii.) that all bodies are porous, and that the pores constitute a larger portion of the volume of a body than is occupied by the solid particles or atoms. These last he conceives to have certain magnitudes, which may be different in different bodies; and he assumes that they are transparent. He supposes also that, like thin plates of any transparent material, the atoms reflect from their surfaces rays of some colour, and transmit through their substance rays of another colour; and on this property he conceives the visible colours of bodies to depend.

The thickness of the atoms of a medium, and the extent of the intervals between them, determine the colours which are transmitted and reflected; but a certain thickness, or extent, is necessary in order to allow reflexion to take place at the surfaces; and if the atoms were too thin, or the intervals too small, to permit any of the particles of light to be so reflected, the whole of the incident light would be transmitted, and a body constituted with such atoms and such intervals would be perfectly transparent.

When a substance, as water, glass, diamond, &c., is of nearly uniform density, the attractions exercised by its molecules on light being nearly equal in every direction, the luminous particles suffer very little variation in the refractions which they experience at the surface, or in the interior of the substance; and thus nearly all of them pass through without interruption. The opacity of such substances as wood, metal, &c., when in masses, is supposed to arise from the numerous changes of direction which the particles of light undergo at or within their surfaces, in consequence of the inequality of the forces exercised upon them by the molecules which they approach; those molecules being supposed to differ from each other in density and in power of attraction: thus the particles of light are either retained in contact with the particles of the material, or are compelled to suffer continual reflexions in its interior, few or none of them escaping at its surface. That transparency depends on the disposition of the particles of which the substance receiving the light is composed may be inferred from the fact that diamond, the most transparent of bodies, becomes, when by a different arrangement of its particles it is converted into charcoal, one of the most opaque.

That an absorption of the particles of light takes place in the interior of certain substances is evident, since pure water, which is very transparent when its depth is small, becomes less so as the depth increases; the violet, the indigo, the blue, the green, the yellow, and the orange coloured rays of the spectrum being successively arrested, and the red rays alone being capable of penetrating far into the water: it has hence been inferred that, at very great depths under the surface of the sea, total darkness prevails. In proof also that opacity results from variations in the attractions exercised on light by the molecules of the substances into which it enters, it may be observed that water and oil, which are equally transparent, but which have different refractive powers, become opaque when they are mixed together; and the like may be said of the ice and air which are combined in the flakes of snow.

If several thin plates of a transparent substance be placed upon one another, the assemblage becomes opaque; and the thickness which will suffice to produce the effect is much less than that which would be necessary if the substance were an undivided mass. The opacity may be conceived to arise from the rays of light being intercepted, and reflected, on the several surfaces at which the plates are placed together. It may be added, that if there be laid upon one another two transparent plates of glass, of different colours, as blue and red, and if a pencil of white light be incident upon one of them, that plate will absorb many of the coloured rays in the pencil, and the other will absorb those rays which may have passed through the former: thus the two plates together will absorb the whole of the light and become completely opaque.

On the other hand, objects which are opaque may be rendered transparent by having their surfaces covered with a substance of uniform density: for example, if each of two pieces of glass be rough-ground on one side, and the ground sides be placed together with a thin layer of oil of turpentine between them, the double glass immediately becomes transparent in consequence of the cavities being filled up with a fluid of nearly the same refractive power as the glass. The porous mineral called hydrophane and the gum called tabasheer, both of which are opaque when dry, become transparent when their pores are filled with water. The like effect will be produced if powdered glass, which, when dry, has the appearance of a white opaque mass from the blending together of the rays of light reflected in every direction at the surfaces of the small fragments of which it consists, be moistened with a fluid of equal refractive power; and also if paper, which consists of numerous ligneous fibres reflecting the incident rays at all angles, be wetted with water or oil, numerous rays of light then finding their way through the material.

The explanation which has been given above is founded on what is called the theory of emission: if the undulatory hypothesis be assumed, it may be conceived that transparency will be caused by the vibrations of the luminiferous æther in the interior of any substance taking place freely through the whole of the mass. Those vibrations being excited by the action at the first surface, and affecting the like æther which is beyond the second. Water, glass, &c. may be so constituted that the vibrations of the æther suffer but little derangement; while, in such substances as wood or metal, the vibrations may be greatly impeded or entirely destroyed.

TRANSPIRATION, PULMONARY, is the exhalation of watery vapour which is constantly going on from the blood circulating through the lungs. Its amount is determined on the one hand by the proportion of water in the blood, and on the other by the temperature and hygrometric state of the atmosphere respired. It is not commonly observed except in cold weather, or when the atmosphere is saturated with moisture; but may always be made evident by breathing on a cold reflecting surface. [RESPIRATION.]

TRANSPLANTING. [PLANTING.]

TRANSPORTATION (*trans* and *porto*), removal, banishment to some fixed place; a mode of punishment.

To this head has been referred, not the subject of penal transportation only, but that of punishments generally [BANISHMENT; PRISONS; PUNISHMENT; REFORMATION, HOUSES OF]; and as this arrangement of subjects, which are more or less distinct from each other, under a general head, may occasion some confusion, we shall indicate the order and mode in which the subjects are severally treated in this article.

First, we shall treat of *Transportation*—its origin as a mode of punishment; acts of parliament relating to it; the system under which it was carried into execution in the American colonies; system under which it was carried out in the early history of the Australian colonies; system on which it was recently executed in New South Wales and Van Diemen's Land—assignment; ticket of leave; chain-gangs and road-parties; penal settlements; expense of the transportation system as hitherto enforced; contemplated changes in the convict discipline of the Australian penal colonies; system of transportation as enforced at Bermuda; theory of transportation.

Secondly, we shall treat of the *Hulks*—their origin, design, and history; description of a hulk; discipline of convicts in the hulks; employments; expense of the system.

Thirdly, *Prisons*—their state at the end of the last century, and the history of improvements in them since; the system of classification; the silent system—its theory and practical working; regulations of the prisons in which this system is in force; the labour imposed on the prisoners—the treadwheel, crank-machine—expense of the silent system; the separate system—its theory, and objections to it; its origin and history in England—principles of prison construction—employments of prisoners—expense of the system; prisons of England generally; treatment of untried prisoners; disposal of prisoners after their discharge; prisons for juvenile offenders—Parkhurst Reformatory.

Fourthly, Institutions in England auxiliary to those for punishment, or Houses of Reformation; Refuge for the Destitute, Philanthropic Institution.

Fifthly, Prisons in Scotland and Ireland, and in the British dependencies.

Sixthly, Capital Punishment.

Lastly, Progress of penal reform in foreign countries.

History of Transportation.—Transportation derived its origin from banishment. [BANISHMENT.] The statute of 39 Elizabeth, c. iv., for the banishment of dangerous rogues and vagabonds, was virtually converted by her successor James I. into an act for transportation to America by a letter to the treasurer and council of the colony of Virginia, in the year 1619, commanding them 'to send a hundred dissolute persons to Virginia, which the knight-marshal would deliver to them for that purpose.' Transportation is not however distinctly mentioned in any English statute prior to the stat. 18 Car. II., c. 3, which gives a power to the judges at their discretion either 'to execute or transport to America for life the moss-troopers of Cumberland and Northumberland.' Until after the passing of the stat. 4 Geo. I., c. 2, continued by stat. 6 Geo. I., c. 23, this mode of punishment was not brought into common operation. By these statutes the courts were allowed a discretionary power to order felons who were by law entitled to their clergy to be transported to the American plantations. Transportation to America under the statutes of George I. lasted from 1718 till the commencement of the War of Independence in 1775.

The unprecedented accumulation of prisoners in the common gaols of the kingdom during the American war drew the attention of several philanthropic individuals to the question of providing an improved penal system. A plan for the establishment of penitentiaries, which was strongly recommended by Judge Blackstone, Mr. Eden (afterwards Lord Auckland), and Mr. Howard, was taken into consideration by parliament, and the act 19 Geo. III., c. 74, for the erection of penitentiaries, passed. The government failed however to adopt the necessary measures for its execution; and transportation was resumed by an act passed in the 24th year of George III., which empowered his majesty in council to appoint to what place beyond the seas, either within or without his majesty's dominions, offenders should be transported; and by two orders in council, dated 6th December, 1786, the eastern coast of Australia and the adjacent islands were fixed upon. In the month of May, 1787, the first band of convicts left England, which in the succeeding year founded the colony of New South Wales.

Acts respecting Transportation.—The present condition of a transported felon is mainly determined by the 5 Geo. IV., c. 84, the Transportation Act, which authorizes the king in council 'to appoint any place or places beyond the seas, either within or without the British dominions.' to which offenders shall be conveyed, the order for their removal being left to one of the principal secretaries of state. The places so appointed are the two Australian colonies of New South Wales and Van Diemen's Land; the small volcanic island called Norfolk Island, situated about 900 miles from the eastern shores of Australia; and Bermuda. The 5 Geo. IV., c. 84, gives to the governor of a penal colony a property in the services of a transported offender for the period of his sentence, and authorizes him to assign over such offender to any other person. The 9 Geo. IV., c. 83, empowers the governor to grant a temporary or partial remission of sentence; and the 2 & 3 Wm. IV., c. 62, limit his power in this respect. Other statutes in which reference is made to transportation merely determine for what crimes it is the punishment. In New South Wales and Van Diemen's Land convicts are subjected to a variety of colonial laws, framed by the local legislatures established under the act 9 Geo. IV., c. 83. (Lang's *History of Transportation; Report of the Select Committee of the House of Commons on Transportation*, 1838.)

System of Transportation as carried into execution in the American Colonies.—Criminals were generally deemed beyond the pale of social rights and interests; the theory of punishment was not studied; and punishment itself was too exclusively regarded as a means of riddance, even more recently than the date of American independence, and we have not many records of the system under which transportation to America was carried into effect. The colonies to which convicts were transported were those of Virginia, Maryland, Delaware, North Carolina, South Carolina, Georgia, New Jersey, New York, and Pennsylvania. According to an estimate obtained by Lord Auckland, the numbers transported to America were, for many years previous to the discontinuance of transportation to our colonies there, about two thousand annually. But Mr. Jefferson represents the convicts as unworthy enumeration, as 'not sufficient to merit it.' (*Memoirs and Correspondence of President Jefferson*, vol. i., p. 406.) Dr. Lang, after comparing different estimates, concludes that the number sent there might be about fifty thousand altogether.

The passage of the convicts to the plantations was contracted for by owners and captains of vessels, who were repaid by the sale of the convicts to the colonists for the period of their sentences. Transported felons were literally 'bought by the planters for the terms specified in their respective warrants, and worked with the negro slaves under the lash of an overseer.' (Lang, p. 37-39.) Among the incidents of this system, it is mentioned by Mr. Bentham that a rich convict, or one whose friends were rich, might easily be released in the mother country by the payment to the captain of the transport of a better sum than could be obtained in the colonial market. (*Theory of Punishment*, ch. 'Transportation.')

At first, we are informed by a contemporary historian, the convicts who were thus transported were very acceptable to the colonists, who considered that their labour would be more beneficial in an infant settlement than their vices could be pernicious. The importation of negro slaves into the American colonies however soon lowered the value of convict labour; and it was thought dangerous to mix white men in a state of slavery with an increasing black slave population. Barbadoes and Maryland successively expressed their aversion to the introduction of British felons: the legislature of Maryland passed an act in 1692 prohibiting ship-masters from landing convicts in that colony. Differences of opinion however continued to exist in the colonies as to the advantages of the system. Where no better description of labour was to be had, it may be concluded, from conflicting accounts, that that of convicts was gratefully received; where better was to be had, that it was condemned or rejected. The American colonies generally had arrived at that state in which felon labour was not desirable, when Dr. Franklin, as a delegate from Pennsylvania, remonstrated against the practice of forcing convicts upon the colonists; and being told that it was absolutely necessary to remove them from England, and that they must continue to be transported to America, replied by asking the English ministers if the same reason would justify the Americans in sending their rattlesnakes to England?

System of Transportation as carried into execution in the early history of the Australian Colonies.—The system under which transportation was carried into execution in the early stages of the history of New South Wales and Van Diemen's Land was determined in some measure by the number of free settlers in those colonies, and by other accidental circumstances, but its main features were these:—Transport vessels were engaged by contract by the British government. Clothing and provisions for the convicts during the voyage, and for a period of nine months afterwards, were supplied in the same way. The owner of the vessel provided a surgeon, approved of at Surgeons' Hall and at the Transport-Office. During the voyage the surgeon, in addition to the care of the health of the convicts, was required to keep a diary, in which everything affecting the discipline maintained on board was to be entered; and at the end of the passage, should the conduct of the master of the vessel be shown to have been satisfactory, a gratuity of 50*l*. was allowed to him; if otherwise, he was liable to be mulcted or prosecuted, according to an article in the contract. Upon the arrival of a transport in the colony, general orders were issued by the local government for returns of the number of men wanted by settlers, with the land held in cultivation by them. The trades, ages, characters, and capacities of the convicts were as fully as possible investigated. Artificers were reserved for the service of the government; convicts who had been in a better situation in life than the average had 'tickets of leave' granted to them, by which they had liberty to provide in the way they chose for themselves, and were exempt from all compulsory labour: similar tickets were given to men unused to active employment, as goldsmiths and the like: the others were distributed as farm and domestic servants among the settlers. The convicts left in or reserved for the service of government were divided into gangs; every gang had an overseer, and every two or three gangs a superintendent: the overseers and superintendents were generally chosen from the best conducted among the convicts. The gangs worked from six in the morning till three in the afternoon, in building, making and repairing roads, and the like; and the rest of the day was allowed to them to be spent in amusement, or in labour the profits of which were their own. They were clothed, fed, and, for the most part, lodged by government. Convicts who misconducted themselves when at work were liable to be punished, by the sentence of a magistrate, either by the cat-o'-nine-tails or by hard labour in irons. Those who were distributed among the settlers were clothed, fed, and lodged by them: they worked either by task, or for the same number of hours as the convicts in government service; and when their set labour was finished, they were allowed to work on their own account. The master had no judicial power over the convict. He was required to appeal, in case of necessity, to a magistrate. The estimated expense of a convict in the service of the government was about 40*l*. per annum; the expense of maintaining a convict to the settler was about 3*l*. (Commissioner Bigge's *Report*.) Female convicts were assigned like the men, chiefly in the capacity of domestic servants.

At the expiration of the period for which convicts were transported, they were at liberty either to leave the colony (at their own expense) or to remain in it. If they decided on remaining, a grant was made to the unmarried of forty acres of land, and to the married of an additional number of acres for the wife and each child: tools and stock were also granted to them, and for eighteen months they were victualled from the government stores. The same advantages were allowed to convicts who were pardoned or emancipated by the governor.

The whole population of New South Wales in 1810 did not exceed (the military being excluded) 10,000; and the bills drawn upon the British treasury for expenses almost exclusively incident to the convict arrangements amounted to 72,600*l*. (*Report of the House of Commons on Transportation*, 10th July, 1812.)

The vices of this system need scarcely be pointed out. The facility with which convicts under sentence for the most heinous crimes obtained entire or conditional freedom, prevented that salutary dread which transportation was designed to inspire, and produced the dangerous result of a free community of criminals. The educated or 'gentlemen' convicts became the leading lawyers, the newspaper editors, the 'patriots,' the tutors, the chief merchants, the wealthy land and flock owners of New South Wales, without their having passed through any discipline calculated to meliorate their character. Commissioner Bigge, who was sent to New South Wales in 1820 to inquire into the operation of the convict system, gives the following illustration of the means by which fortunes were accumulated by convicts:—'Samuel Terry was transported when young. He was placed in a gang of masons at Parramatta, and assisted in the erection of a gaol there. By disposing to other prisoners of his allowance of spirits, and by habits of industry, he was enabled to set up a retail shop, in which he continued till the expiration of his sentence. He then repaired to Sydney, where he extended his business, and by marriage increased his capital. He for many years kept a public house and retail shop, to which the smaller settlers (most generally emancipists) resorted from the country, and where, after intoxicating themselves with liquors, they signed obligations and warrants of attorney to confess judgment, which were always kept ready for execution. By these means, and by an active use of the common arts of overreaching ignorant and worthless persons, Samuel Terry had been able to accumulate a considerable capital, and about 20,000 acres of land, besides sheep, cattle, &c.' This man, when he died about five years since, was worth 40,000*l*. per annum. (*Transportation Report*, 1838, p. 18.)

During the long period of thirty or forty years after the establishment of New South Wales as a penal settlement, there was an entire neglect of the religious improvement of the convicts. Spirits were distributed to such an extent as to render the universal prevalence of habits of drunkenness inevitable. According to Dr. Lang, besides a regular and ample ration of ardent spirits that was served out to all free persons in the service of the government, whether civil or military, there were periodical issues of large quantities, free of duty, to government officers of all ranks. . . . Until 1816, when the practice was discontinued by an order of the secretary of state, ardent spirits were held by the colonial government as the circulating medium or current coin of the colony; they were given in payment for work of every description performed for government. . . . . Shortly after the commencement of the present century, the colony had become one scene of brutal dissipation and licentiousness, of lawless violence and rapine. It was no uncommon occurrence for men to sit down round a bucket of spirits, and drink it with great quart pots, until they were unable to stir from the spot; and frequently the settler involved himself so deeply in debt by drunkenness that it terminated in his ruin. (*History of Transportation*, pp. 77-80.)

The transportation system received at different periods a partial correction. A limitation was put upon the discretion of the governor of a penal colony in the emancipation of convicts, and the exercise of that discretion was subjected to the ultimate approval of the secretary of state. Convicts were restrained from certain employments, such as those of conducting the press and practising the law, and the custom of granting lands to them on their emancipation was abolished.

The main features of the transportation system were however retained; and assignment continued to be the first stage of a convict's punishment. The following may be taken as the outline of the system till about the period at which we write, when there is a transition being made to another set of arrangements.

Assignment.—According to the official memorandum laying down the duties of a convict in assignment, he is required to devote his whole time and his best services to his master. A fixed but limited ration is allowed, and clothing of the commonest description, according to an approved scale, must be furnished by the master, together with decent bedding and surgical attendance when required, but no money. The penalties attached to misconduct in assignment are flogging, solitary confinement, labour in a road-party or a chain-gang, and transportation to a penal settlement. A convict who has escaped punishment while in the state of assignment is eligible to receive a 'ticket-of-leave' at the end of four years, supposing his sentence of transportation to extend to seven years; at the end of six, if it be for fourteen; and at the end of eight, if his sentence be for life.

Ticket-of-Leave.—A ticket-of-leave 'entitles the holder to choose his own employment, and to enter into an engagement as a free labourer, or to carry on business on his own account,' and it imposes on him the obligation of attending divine service weekly, if there be a place of worship in the district in which he resides; of being present at occasional musters, and confining himself to the limits of the district, unless special leave of absence is granted. The first conviction for any offence exposes the possessor of a 'ticket-of-leave' to forfeit it, and to be returned to the state of bondage from which his ticket released him.

The system described is applied to female as well as male convicts, with some minor deviations in detail.

From the outset the regulations of this system contemplate, not the degrees of guilt and its due punishment, but accommodation to the economical wants of the free colonists. From the outset they abandon the convict to the chance treatment of settler-masters. The government reserves to itself only a casual part to act in reference to the punishment or reform of an offender. Regulations may be laid down, and obedience to them on the part of the receivers of assigned servants be demanded by the authorities; but regulations which refer to the domestic concerns of many hundred dispersed establishments cannot be enforced. Thus the conditions of three hundred convicts, landed from the same vessel, may be as various within a month after their arrival, as the tempers, caprices, and circumstances of nearly as many masters.

The operation of assignment in respect to female convicts is even worse than in respect to male. The evidence on this head given before the Transportation Committee is thus referred to in the Committee's Report: 'The general condition of females in this situation, according to the testimony of every witness examined, is as bad as anything could well be . . . . . At times they are excessively ferocious, and the tendency of assignment is to render them still more profligate: they are all of them, with scarcely an exception, drunken and abandoned prostitutes; and even were any of them inclined to be well-conducted, the disproportion of sexes (about one female to ten men) is so great, that they are exposed to irresistible temptation: for instance, in a private family, in the interior of either colony, a convict woman, frequently the only one in the service, perhaps in the neighbourhood, is surrounded by a number of depraved characters, to whom she becomes an object of constant pursuit and solicitation; she is generally obliged to select one man as a paramour, to defend her from the importunities of the rest; she seldom remains long in the same place; she either commits some offence for which she is returned to the government; or she becomes pregnant, in which case she is sent to the factory to be there confined; at the expiration of the period of her confinement or punishment, she is re-assigned, and again goes through the same course.'

The ticket-of-leave, the first stage in the progress of a convict to restored liberty, is a feature of the transportation system which has been generally commended. Captain Maconochie, whose testimony is frequently referred to in the 'Transportation Report,' approves of it in everything but its relation to a system, the first stage of which, assignment, is liable to all the objections which have been made to slavery. Before coming to the possession of his ticket in assigned service, the convict, instead of being amended, is so much further depraved, that this relaxation proves in many cases only a step to a worse condition than before, an enlarged opportunity for the commission of crime, and occasion of becoming obnoxious to its penalties,—penalties for offences which an employer has not the same interest with a hired as with an unpaid or assigned servant to conceal; because it is comparatively difficult to obtain another assignee,—easy to obtain a hired servant. The alternation in the life of a ticket-of-leave convict appears to be between excessive and profitable labour for one season, and excessive and ruinous debauchery for another. Although some convicts of remarkable power in withstanding the force of circumstances, of sagacity sometimes reputable, but more often dishonest in the use of advantages, have arisen to wealth; yet, considering the immense numbers of this class in the Australian penal colonies, and the great encouragements held out there to industry and foresight, the number of those who have done this is very small.

As in the early, so in subsequent stages of the history of the penal colonies, drunkenness has been the great vice among convicts and emancipists. Dr. Lang, writing in

1837, shows that at that period 'the consumption of ardent spirits in New South Wales amounted to 3⅜ imperial gallons annually for every man, woman, and child in the colony; the entire consumption for the United Kingdom being one gallon and a small fraction for each individual. Allowing however (he says) for convicts in actual bondage (in road and chain gangs), to whom spirits are not issued, and for children and other natives of the colony, *who are generally indisposed to the use of ardent spirits*, the number of actual consumers is so reduced, that for each consumer there must be the enormous amount of eight gallons a year. During the period of his actual bondage the convict is understood not to be allowed ardent spirits: but in the service of private settlers he has the means of procuring the indulgence independently of his master. Emancipated convicts are scattered all over the territory, and frequently obtain their livelihood not by honest industry, but by corrupting the convict and emancipated convict population—selling ardent spirits *on the sly*, as it is called, and receiving in exchange property in goods that are generally pilfered or stolen from their owners for the express purpose of procuring the means of indulgence.' (*History of Transportation*, pp. 83-85.)

The amount of petty offences in the penal colonies and of convictions for drunkenness is very great. In 1835 the number of convicts in New South Wales was about 28,000, and the summary convictions for petty offences in the year were estimated to be about 22,000. (*Transportation Report.*) In Van Diemen's Land in 1832 the convictions were as $43\frac{67}{127}$ for every hundred of the convicts. After 1832 the returns from which this proportion is taken are differently made out, and the several heads of offence are multiplied, yet with few exceptions the same general fact is evident. (*Australiana*, 1838.) From the character of the convict system it is evident that the convictions for petty crime fall greatly short of what is actually committed.

The following returns exhibit the amount of grave crimes committed in New South Wales and Van Diemen's Land, in each year between 1828 and 1836, the description of crimes, with the number of the population:—

NEW SOUTH WALES.

	1829.	1830.	1831.	1832.	1833.	1834.	1835.
Population	41,457	46,276	51,115	55,954	60,794	66,228	71,662
Number of convicts	..	..	..	..	24,543	..	..
Convicted of offences committed with violence:—							
Murder	10	9	16	9	11	20	19
Attempts to murder	4	2	11	9	11	16	17
Manslaughter	1	4	0	0	0	3	1
Rape	2	2	2	1	10	5	13
Unnatural crime	0	2	2	1	0	7	0
Highway-robbery and bush-ranging	33	24	28	36	58	111	89
Burglary	29	25	29	16	22	29	25
Piracy and revolt	5	0	0	23	0	6	0
Misdemeanour and assault	6	19	38	56	58	78	87
Total	99	87	126	151	170	275	251
Convicted of offences committed without violence.—							
Arson	2	0	2	2	0	1	2
Forgery	5	3	4	5	7	14	15
Cattle, horse, and sheep stealing	14	18	17	27	15	62	67
Perjury	1	0	4	1	8	9	3
Larceny and receiving stolen goods	154	161	185	192	239	229	347
Total	176	182	212	217	269	315	434
Grand total	266	269	338	368	439	590	685
Sentences and executions:—							
Sentenced to death	69	41	82	63	63	80	86
Executed	52	50	32	12	31	44	38
Transported	118	125	116	148	171	317	398
Proportion of offenders to population was as	1 : 157	1:171⅓	1 : 151	1 : 152	1:138¼	1:112¼	1:104⅔
Proportion of offences with violence to those without was as	1 : 2	1 : 2	1 : 1⅔	1 : 1½	1 : 1½	1 : 1¼	1 : 1½

The proportion of convicted offenders to population in England and Wales is as 1 to 850.

The proportion of crimes with violence to those without is as 1 to 8½.

VAN DIEMEN'S LAND.

	1829.	1830.	1831.	1832.	1833.	1834.	1835.
Population	20,265	24,504	26,830	29,079	34,450	37,7[illegible]	[illegible]
Convict population	..	..	..	..	..	15,5[illegible]	[illegible]
Convicted of crimes against the person with violence:—							
Murder	3	10	0	4	1	3	[illegible]
Cutting with intent	0	6	2	18	10	10	[illegible]
Carnally knowing	0	6	2	3	0	0	[illegible]
Bestiality	0	2	0	0	1	0	[illegible]
Highway robbery	6	8	2	2	13	4	[illegible]
Bushranging and absconding	5	4	20	20	0	3	[illegible]
Burglary	27	38	6	26	35	25	15
Assault and misdemeanour	9	20	40	27	22	21	27
Total	50	94	79	103	82	66	51
Convicted of offences against property without violence:—							
Arson	0	1	0	1	0	0	[illegible]
Forgery	0	2	5	3	6	14	[illegible]
Cattle and horse stealing	11	2	6	4	18	16	14
Sheep-stealing	17	6	1	10	12	20	14
Perjury	0	1	2	2	1	0	[illegible]
Libel and contempt	0	0	0	1	1	0	2
Embezzlement	0	3	6	16	11	9	7
Felony	16	9	5	3	19	14	[illegible]
Receiving stolen goods	10	11	23	12	20	39	41
Larceny and theft	89	115	160	142	192	286	[illegible]
Total	143	150	208	194	280	398	306
Grand total	193	244	287	297	362	464	357
Sentences and executions:—							
Sentenced to death	40	66	31	82	88	78	51
Executed	19	30	4	13	12	13	[illegible]
Transported	1[illegible]0	131	159	171	213	235	151
Proportion of offences committed with violence to those without	1 : 3	1 : 1½	1 : 2½	1 : 2	1 : 3½	1 : 6	1 : [illegible]
Proportion of offenders to population	1 : 105	1:100½	1 : 94½	1 : 98	1 : 95	1 : 81¼	1 : 1[illegible]

On the above returns the Transportation Committee in their Report remark: 'They show that, in proportion to the respective population of the two countries, the number of convictions for highway robbery (including bush-ranging) in New South Wales, exceeds the total number of convictions for all offences in England; that rapes, murders, and attempts at murders are as common in the former, as petty larcenies in the latter country. In short, in order to give an idea of the amount of crime in New South Wales, let it be supposed that the 17,000 offenders who last year (1837) were tried and convicted in this country for various offences before the several courts of assize and quarter-sessions, had all of them been condemned for capital crimes; that 7000 of them had been executed, and the remainder transported for life; that—including in this remark the returns from Van Diemen's Land also—in addition, 120,000 other offenders had been convicted of the minor offences of forgery, sheep-stealing, and the like, then, in proportion to their respective populations, the state of crime and punishment in England and Australian colonies would have been precisely the same.'

The convictions however in New South Wales, it would appear, fall short even more than usually of the number of crimes committed. Judge Burton, in a charge to the grand jury of Sydney, which is frequently adverted to in the Transportation Report, after describing 'the crimes of violence, the murders, the manslaughters and drunken revels, the perjuries, the false witnesses from motives of revenge or reward, which in the proceedings before him had been brought to light;' after mentioning 'the mass of offences which were summarily disposed of by the magistrates, and at the several police-offices throughout the colony,' spoke of 'the numerous undiscovered crimes, which every man who heard him, or to whom the report of his words should come, would at once admit to have occurred within his own circle of knowledge,' and added that 'the picture presented to men's minds would be one of the most painful reflection; it would appear to one who could look down upon that community as if the main business of them all were the commission of crime and the punishment of it; as if the whole colony were in motion towards the several courts of justice.' (*Transportation Report*, p. 27.)

Road-Parties and Chain-Gangs.—Road-parties, chain-gangs, and penal settlements have been mentioned among the punishments to which a refractory or offending convict is liable. The two first embrace the punishment of hard labour on public roads, in breaking stones and the like; the chain-gang being distinguished by the additional severity of a more degrading dress, heavy chains on the legs, and the superintendence of armed soldiers instead of convict overseers. The stations at which the convicts in road and chain gangs are kept are removable according to the public wants: they are therefore rudely constructed in every particular, generally consisting of so many huts, little better than the commonest description of cow-houses, each of which is adapted to the reception of thirty men, more or less. The convicts are locked up in these places at night with some rough covering for their bedding. In the morning they are brought out under inspection, hear the reading of a chapter or the prayers of the Church of England, and then proceed to work, which is interrupted at stated hours, when they receive their meals. Sir Richard Bourke, late governor of New South Wales, in his evidence before the Transportation Committee, represented the condition of *some* of the convicts in chain-gangs as one of peculiarly great privation and unhappiness; the men being 'locked up from sunset to sunrise in caravans or boxes holding from twenty to twenty-eight men, but in which the whole number can neither stand upright nor sit down at the same time (except with their legs at right-angles to their bodies), and which, in some instances, do not allow more than eighteen inches in width for each individual to lie down upon on the bare boards.' This feature of a barbarous system has however been discontinued for some years.

The Transportation Committee thus summarily describe the evidence on these portions of the convict system:—'Every one of the witnesses spoke in the strongest terms of the disorders, crimes, and demoralization which were occasioned by the road-parties.' 'All are ultimately degraded and demoralised by associating together.'

Penal Settlements.—Penal settlements are designed for the punishment of criminals convicted of very grave offences in the penal colonies, and of criminals who are specified in the instructions of the secretary of state forwarded to the governors of the colonies with every transport vessel. In connection with New South Wales, the penal settlement is Norfolk Island: in connection with Van Diemen's Land, there was formerly Macquarie Harbour; at present there is Port Arthur.

Macquarie Harbour is a large bay situated on the western coast of Van Diemen's Land. There are several small islands scattered about the bay, two of which were occupied as penal settlements; one as a place of burial, and another as a garden. A small rock was used as a place of punishment for the refractory convicts to be sent to at night. This was considered as a minor description of punishment, but according to the testimony of the surgeon who was employed at Macquarie Harbour, it was very severe indeed; because it seldom happened that an individual could land upon the rock without getting wet, and the result was that he was obliged either to sleep in his wet clothes, or without any clothing; the greater part slept in their clothes, nine-tenths having on heavy irons: fire was not allowed after eight at night, and the prisoners did not reach the rock till between six and seven. Another kind of punishment was stopping the allowance of meat; and a third was placing them in the chain-gang to work in heavy irons, and to work in water carrying stones or diving for them. The last description of punishment was flagellation with a cat-o'-nine-tails, of double-twist whip-cord, and nine-knotted. Executions were common, and were generally performed in the presence of the assembled convicts, under the impression that such spectacles would overawe them and repress crime.

From an official return it appears that out of 116 men who absconded from Macquarie Harbour, 75 are supposed to have perished in the woods, 1 was hanged for murdering and eating his companions, 6 of whom were eaten; 24 escaped, 13 were hanged for bush-ranging,* and 2 for murder: making a total of 101 out of 116 who came to an untimely fate. (Evidence of Mr. Barnes, *Transportation Report*, 1838.)

Macquarie Harbour was entirely abandoned in 1834, in favour of the present penal settlement connected with Van Diemen's Land, Port Arthur, of which the foundation was laid in 1830. Port Arthur is admirably fitted by geographical position for the purposes to which it is devoted. It has no communication with the rest of Van Diemen's Land, except by a narrow neck about 450 yards wide, which is guarded by military, and by a line of dogs chained to lamp-posts; the dogs are fed on raw flesh, and so trained that the very slightest noise by night or day instantly alarms them. The convicts at Port Arthur are employed with chains on their legs, in felling timber and sawing it, in working in coal-mines, and in different mechanical trades. They are classified according to their description, as 'gentlemen' convicts, to the heinousness of their offences, and their conduct while enduring their sentences. The editor of the 'Van Diemen's Land Almanack,' in an account of a visit to this settlement in 1836, mentions as 'one of the most severe duties the prisoner is put to perform, the carrying of large logs from the interior and almost impassable parts of the woods to the beach, and again landing and transporting them through the water to the dry ground and dock-yard. . . . Self-preservation compels every one to do his best to support the immense weight, which, notwithstanding, he must be strongly impressed within himself would crush him at once to death, whatever his efforts might be, unless his companions in like manner did their part.'

There is an establishment for boys at Port Arthur, the mode of discipline in respect to whom is as follows:—They rise every morning at five o'clock, and having stowed away their bedding, assemble for worship, after which they are inspected as to personal cleanliness, previous to breakfast, which takes place at seven o'clock; after breakfast they disperse for recreation, and at eight begin the daily labours; at twelve they are again inspected, as before, previous to dinner; labour is suspended until half-past two, at which hour they resume it, and continue at work till five o'clock, when they sup. At a quarter past six they muster for school, which continues one hour, and the engagements of the day are closed by singing a hymn, the reading of scripture, and prayer. On Saturday afternoon no work is performed, except by such as have misconducted themselves during the week. On Sunday they rise as usual, attend morning prayers, and at nine o'clock clean linen and soap are issued to them for the week; at half-past ten they congregate for divine service, and the rest of the day is spent chiefly in receiving religious education. The school education given to the convict boys is confined to plain reading, writing, and the simple rules of arithmetic. The trades they are taught are such as are most likely to be useful to them in a new country, and are the trades of boot and shoe makers, carpenters, blacksmiths, nailors, tailors, coopers, bakers, kitchen-gardeners, and sawyers, book-binding, and turning in the different branches. The boys on their arrival are employed in what is termed the 'labouring-gang,' breaking up new ground, cultivating the government garden, carrying sawn timber from the pits for use and shipment, making roads, felling, cross-cutting, and splitting timber for firewood for the use of the establishment, carrying the same, washing and cooking, and all duties connected with their own wants and attendance. The boys are allowed to amuse themselves in any innocent manner within the prescribed bounds at any of their leisure intervals. The most trivial crime or irregularity is not permitted to pass without some punishment proportioned to its nature. The punishments are various: first, confinement to the muster-ground during cessation from labour, where no amusement is allowed; the next punishment in severity is confinement in a separate cell, the monotony of which is not relieved by employment except at stated times, when the prisoner is liberated to attend school; the third punishment is confinement in a cell on bread and water, the allowance of bread not exceeding one pound per diem. The last mode of punishment, which is inflicted in cases of determined violation of the regulations, is flogging on the breech. Since the 30th June, 1837, the nature of the discipline at Point Puer (as the boys' establishment at Port Arthur is called) has not undergone any change. No regular reports are published by government.

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* 'Bush-ranging,' running away and living by depredations upon the settlers.

The foregoing details are taken nearly verbatim from a report of the Commandant of Port Arthur to the government of Van Diemen's Land. It is to be observed that the settlement is not open to general inspection, so that it is difficult to obtain an unprejudiced view of the operation of the system pursued there. It does appear however from evidence before the Transportation Committee, and from statistical returns, that many of the boys punished there, on their liberation become obnoxious to punishment again.

The discipline of the adult criminals at Port Arthur is excessively degrading; it hardens the convicts, and the most horrid acts of despair have been its fruits. The writer in the 'Van Diemen's Land Almanack,' quoted above, remarks that 'the desperation to which some of these wretched men sometimes sink is truly appalling. Several instances are on record (he continues) of men committing the most barbarous murders in open sight of their companions and superiors, with no other intention than to be arrested, sent up to Hobart Town, tried, convicted, and executed.' The chief police magistrate of Van Diemen's Land says that a convict is sure to return from Port Arthur more vicious and more hardened in guilt than he was before. (*Despatch on the Convict System of Van Diemen's Land, ordered to be printed April 26th*, 1838.) That officer defends the system pursued there only as a means of deterring. Sir George Arthur, late Governor of Van Diemen's Land, says that the moment a convict is released from that settlement, he falls again into crime on the slightest temptation. (*Evidence*, q. 4321, *Transportation Report*, 1837.)

Including 270 boys from 10 to 18 years of age, in 1836, there were 1181 prisoners at Port Arthur; 286 prisoners had been sent from the settlement during the previous year, and 466 had been received—45 for the second time. Since 1836 the accommodations at Port Arthur have been increased, and the number of convicts also.

Norfolk Island is described as one of the loveliest spots in the southern hemisphere. It is remote from any land, and inaccessible excepting at two points, where at particular seasons a landing for passengers can only be effected by means of boats. The island is about twenty-one miles in circumference, of volcanic origin, and 'consists of a series of hills and valleys, curiously interfolded, the green ridges rising one above another, until they reach the shaggy sides and crowning summit of Mount Pitt, at the height of 3000 feet above the level of the sea. The establishment consists of a capacious quadrangle of buildings for the prisoners, the military barracks, and a series of offices in two ranges. A little farther beyond,' continues the writer, whose rather poetical description, for want of any other, we are obliged to quote, 'on a green mount of nature's beautiful making, rises the mansion of the commandant, with its barred windows, defensive cannon, and pacing sentry. Straying some distance along a footpath we come upon the cemetery, closed in on three sides by close, thick, melancholy groves of the tear-dropping manchineal, whilst the fourth is open to the restless sea. The graves are numerous and recent, most of the tenants having reached, by an untimely end, the abode to which they now contribute their hapless remains and hapless story. I have myself witnessed fifteen descents into those houses of mortality, and in every one lies a hand of blood. Their lives were brief, and as agitated and restless as the waves which now break at their feet, and whose dying sound is their only requiem. The severity of the discipline which has been pursued at Norfolk Island has varied with the character and feelings of commandants, who are usually intrusted with a limited discretion; but its main features in detail have been the same as those of the system pursued at Macquarie Harbour and Port Arthur—a system of hard labour and degrading punishment. Many instances are known of capital crimes having been committed at Norfolk Island for the sake of release from its severities even by the sacrifice of life. In reply to a question put by the Transportation Committee, the chief justice of New South Wales said, that he would not hesitate to prefer death, under any form that it could be presented to him, rather than such a state of endurance as that of the convict transported to that island.' Dr. Ullathorne, a Roman Catholic priest, who was sent from Sydney to perform the last services of religion to a number of men under sentence of death for mutiny at Norfolk Island, and who was likewise entrusted with the office of informing eleven of the condemned of their reprieve, has thus described his meeting with the objects of a mission so remarkable:—'I said a few words to induce them to resignation, and then stated the names of those who were to die; and it is a remarkable fact that as I mentioned the names of those men who were to die, they one after another dropped on their knees and thanked God that they were to be delivered from that horrible place, whilst the others remained standing mute and weeping. It was the most horrible scene I ever witnessed. Those who were condemned to death appeared to be rejoiced.' (q. 267– *Evidence, Transportation Report*, 1838.)

Of the depravity at Norfolk Island, Judge Burton (of the New South Wales bench) has given this striking testimony, that 'it wrung his heart and drew tears from his eyes, when a (Norfolk Island) convict brought before him for sentence observed, "Let a man be what he will when he comes here, he is soon as bad as the rest: a man's heart is taken from him, and there is given to him the heart of a beast."' And Dr. Ullathorne, to the same effect, expressed himself, before the Transportation Committee, to have been very much struck by the peculiar language used by the convicts at Norfolk Island. 'When a prisoner (he said) has been conversing with me respecting another individual, he has designated him as a good man. I suspected that he did not mean what he said; and on asking an explanation, he has apologised, and said that it was the habitual language of the place; and that a bad man was called a good man, and that a man who was ready to perform his duty was generally called a bad man. There was quite a vocabulary of terms of that kind, which seemed to have been invented to adapt themselves to the complete subversion of the human heart.' 'The outward appearance of the great body of the convicts,' he added, 'was very shocking, exhibiting the hard and fixed traces of crime upon their countenances.' (*Transportation Report*.)

The number of convicts at Norfolk Island during the period to which the foregoing accounts refer varied from two hundred to a thousand, all, as at the penal settlements of Macquarie Harbour and Port Arthur, being male.

Expenses of Transportation.—Up to the year 1836, 100,000 convicts had been transported from this country to the Australian penal colonies, of whom 13,000 were women. The following estimate of the sums expended on account of those colonies falls short of the true amount:—

Cost of the transport of convicts . . .	£2,729,790
Disbursements for general, convict, and colonial services	4,091,581
Military expenditure	1,632,302
Ordnance	29,846
Total from 1786 to 31st March, 1837,	8,483,519
Deduct for premium on bills, coins, &c.,	507,195
	7,976,324

The conveyance of each convict has thus cost about 28*l*., and the various expenses of residence and punishment have been at least 54*l*. a head, making in all more than 82*l*. a head. The expense entailed upon this country by the penal colonies has been, on the average since their commencement, 156,398*l*. a year; but at present the annual expenditure is more than treble that amount, and is rapidly increasing.

The following was the expenditure of this country on account of New South Wales and Van Diemen's Land in the year 1836-7:—

New South Wales.

Ordinances of the army . . .	£46,801
Commissariat	3,450
Ordnance	12,014
Navy	4,641
Extraordinaries of the army . .	55,625
Special disbursements on account of convicts	127,949
	£250,480

Van Diemen's Land.

Ordinances of the army	£16,354
Commissariat	2,059
Ordnance	11,625
Navy	515
Extraordinaries of the army	20,867
Special disbursements on account of convicts	113,083
	164,503
Transport of convicts	73,030
Total expenditure for the year 1836-7.	£488,013

(*Transportation Report.*)

In addition to this sum, the colonial expenditure on account of the administration of justice, gaols, and police was 90,000*l.*, an amount nine times as great in proportion to the population as that of the United Kingdom for similar purposes. (Sir William Molesworth.)

In 1837 a committee of the House of Commons was appointed to inquire into the subject of transportation, and to suggest improvements. The labours of that committee have been followed by some changes, and there is a prospect of still greater.

New System of Convict Management in the Australian Colonies.—At Norfolk Island a system of a novel character is in operation, under the superintendence of its author, Capt. Maconochie; and in Van Diemen's Land a system based on some of the principles of that of Capt. Maconochie, and embracing also some of its details, is now in process of adoption.

Capt. Maconochie conceives that the fundamental error which characterises the usual modes of convict discipline is the non-separation of the processes of punishment and reform. He proposes that they should be distinctly contemplated and distinctly pursued. By the word punishment he does not mean vindictive or exemplary infliction, but the sobering of the convict's mind, so as to fit it to derive benefit from the moral influences which he would bring to bear upon it. Thus, it should not (he says) be degrading: it should be in seclusion from the gaze of the free population altogether, at stations which he would have so constructed as to be removable at will, according as the scope or demand for useful labour, or other circumstances should suggest. The process should consist of hard labour (enforced, if necessary, by physical means), with instruction, moral, religious, mechanical, and agricultural, so as to fit the prisoners for constituting afterwards a good rural population. This state of discipline might, or might not, according to the author's plan, embrace a period of *separate* confinement; but it must embrace a period of *social* discipline.

The reformatory or probationary process Capt. Maconochie recommends should be regulated by the use of moral influence. The prisoners should be brought from the punishment stations to this stage of their discipline in parties of six (more or less), who should choose each other, and agree to run the chances of their probation together. Thus, after a man has completed the period during which, according to his original sentence, he must remain under direct punishment (physical restraint), he must remain indefinitely longer, until he can persuade other five men similarly circumstanced so far to believe in his good intentions as to be willing to connect their own fate in probation with his, and to rise or fall, as afterwards explained, according to his and their own conduct jointly. It is contended that the necessity which will thus be imposed on all, even in their first stage, to cultivate the good opinion of their fellows, will of itself produce a good moral effect, and advantageously prepare them for their further trials: for it will give a value to the *social virtues*, usually excluded from the receptacles of criminals; and will prevent favour or hypocrisy from deriving undue advantages. These parties, when entered on their probation, it is proposed should be reckoned with every evening by the superintendent under whom they may be employed in the government works, and should receive marks to their credit or discredit, according to their conduct. If they have been orderly, obedient, sober, zealous, attentive, active, industrious, cleanly in their persons and rooms, civil, temperate under provocation (should such have been offered to them), punctual in their attendance (at prayers, school, work, &c.), or have in any other way deserved commendation, they should be gainers accordingly; and if, on the other hand, any one deserves censure, his party should in proportion suffer. The stations, it is recommended, should resemble common life in their different arrangements:—'I would not (says Capt. Maconochie) confide the good conduct of those who, from their position, must be considered short-sighted in their views of permanent advantage, solely to the support of distant inducements; but, for their benefit, I would make the marks *a mere current coin*. . . . I would open stores at each station, at which supplies of every kind, *even spirits*, could be obtained in exchange for marks as registered in the superintendent's book, *but for no other consideration.* I would thus obtain a strong, immediate, as well as distant stimulant; a strong deterrent from evil; a means of paying wages and imposing fines which could not be itself stolen or clandestinely transferred; a means also by which indulgence could be legitimately obtained; yet a strong remaining interest in each of the parties to exercise economy and self-denial; for only the residue (fixed in amount) of their marks, after paying for these gratifications and the ordinary expenses of living, would go to purchase their liberation. Every one would think he enjoyed full freedom of will, yet every one would be under the almost absolute control of impulses common to all, yet personal to each, and which could not fail therefore of generating an *esprit de corps* productive of harmonious effect.' The next step contemplated in the progress of the convict to complete liberty is a 'ticket-of-leave,' unclogged however by the restrictions imposed under the old system on the holder (such as attending musters, proceeding in a body to church, &c.), and not liable to forfeiture but by a sentence solemn and judicial. (*Australiana, or Thoughts on Convict Management*, by Capt. Maconochie, London, 1838.)

The *Social System* of convict management (the designation which, in antithesis as it were to the *separate system*, Capt. Maconochie gives to his plan) has been in operation for the last two or three years at Norfolk Island, whither all male convicts destined for New South Wales are in the first instance now sent. No reports on the operation of this great change have yet been published by the government at home, and any other accounts would be unsatisfactory.

The new system in progress of adoption in Van Diemen's Land is termed a Probation System, and the object to be held in constant view is to teach the convicts habitually to regard whatever degree of labour and coercion they may be subjected to as the desert and consequence of guilt. The discipline is therefore to be rigorous; but at the same time tempered with judicious advice and moral and religious instruction. A principle to be invariably acted upon is, that the character and conduct of the convicts, and not their ingenuity alone, are to determine the kind of labour to be allotted to them; those who manifest a bad or restless disposition being always employed upon that which is most irksome. No convict is to have power or control over another, or to be employed in any permanent situation of ease or trust. Cleaning wards, sweeping barracks, cooking, watching, &c. must be performed by the convicts as duties generally; such alone being exempted from these duties as are under temporary increased punishment. Indulgences of any kind are prohibited, such as tobacco and spirits.

The magistrates appointed to visit the probationary parties are enjoined to study the temper and disposition of the men to be punished; for it is obvious that the same description of punishment inflicted upon men of different dispositions and understandings will not be of equal effect. In general, recommendations of short extensions of probation are pointed out as the best mode of punishment, excepting in cases of serious crime. In the case of offenders brought before them for sentence, the magistrate is desired to explain calmly and patiently the grounds upon which sentence is passed, and to point out the folly of a continuance in ill-conduct. Monthly reports are required from each visiting magistrate on the general state of the gangs under his magisterial care, containing any suggestions which may strike him as likely to improve their discipline and conduct.

Upon the superintendent devolves the whole responsibility of the discipline and management of the gangs.

They are charged with the safe custody of the convicts and with the control of the assistant-superintendents. He is to see that the convicts go to their beds and rise at the proper hours; that they are clean in their persons; and that they are marched off to their places of labour at the regulated hours, each class with its own assistants; and that they are marched back to the station after their daily labour is over, in the same manner. The superintendent and his assistants are constantly to mix with the gangs whilst at labour, as well as in their quarters; they are required to check every kind of irregularity, whether in speech or manner; to advise and remonstrate with the disobedient, and to act as monitors generally to the convicts under their charge. It is only when these means fail that they are to bring the disobedient before the visiting magistrate. The superintendent is to see the rations distributed, to inspect the huts and places of confinement, paying great attention to ventilation, and observing that the separation-boards between the different berths are frequently removed; to inspect the bedding at least once in every week, or to have it aired. He is not to allow anything like reproachful or harsh language to be used by any person in authority; and he is to take care that communication by unauthorized persons with the convicts is prevented.

The gangs are to consist of from two hundred and fifty to three hundred men, and to be divided into three classes. The classes are to be subdivided into other classes, and these into messes of ten men each. The third class is to be subjected to the separate system of confinement: the second is to be hutted in rooms containing ten men each: the first class is to be composed of those convicts whose term of probation will soonest terminate, and will be distributed in huts containing twenty men each.

The different classes of convicts are never to be mixed either at labour or elsewhere.

The superintendent is to muster and inspect the convicts immediately before they commence work, and afterwards to read prayers. Books are to be circulated among the men for their perusal on Saturday and Sunday (on which day service is to be twice performed); and upon days on which the usual labour cannot be performed owing to the state of the weather, as well as on Saturday afternoon, such convicts as are desirous of obtaining instruction in reading will be allowed to attend in a hut for that purpose.

Perfect silence is to be kept at the musters, but it does not form part of the punishment to be enforced when at labour. The hours of labour will vary with the seasons; in the months of November, December, January, and February, being from half-past five A.M. to six o'clock in the evening; allowing from eight to nine o'clock for breakfast, and from twelve to one for dinner; in March, October, April, and September, from half-past six A.M. to half-past five P.M., the same hours being allowed for breakfast and dinner; May and August, from eight A.M. to five P.M.; June and July, from eight A.M. to half-past four P.M.

The labour required from convicts in probationary gangs will consist in the various works incident to the making and repairing of roads and bridges.

The punishments attached to drunkenness, absence without leave, disobedience of orders, idleness, neglect or wilful mismanagement of work or duty, indecent or abusive language, profane swearing, insolence or other misconduct, are hard labour, in or out of chains, not exceeding one year, or solitary confinement not exceeding fourteen days, or by exposure in the stocks not exceeding six hours, or by whipping, not exceeding thirty-six lashes.

The periods spent in the probation-gangs will depend upon the original sentence of the several convicts, and upon their good or bad conduct in probation.* (*Standing Orders for the Regulation of the Probation System of Convict Labour in Van Diemen's Land*, Hobart, 1841.)

System of Transportation as carried into execution at Bermuda.—All convicts sent to Bermuda are employed by the government on public works in the dockyards. The system of punishment pursued is essentially different from that which has been in force in the Australian penal colonies, and closely resembles that adopted in the hulks in this country. The convicts sent to Bermuda are selected as being the best behaved; they are kept apart from the free population; they are shut up in hulks by night, and are worked in gangs by day under the superintendence of free overseers. A small amount of wages is paid to them for their labour, a portion of which they are allowed to spend, and the remainder forms a fund, which they receive on becoming free. At the expiration of their sentence, they do not remain in Bermuda, but are sent back at the expense of the government of this country. Transportation to Bermuda, with some points of recommendation compared with transportation to the Australian colonies, is thus, on the other hand, without the argument in its favour, that it rids England of the criminals sent to it. (Capper's *Reports*.)

Theory of Transportation.—Mr. Bentham, Dr. Whately, the present archbishop of Dublin, and other writers on the theory of punishment, have condemned the general principle of transportation; and comparatively little has been urged in opposition to their arguments. Mr. Bentham's objections will be found in a chapter on Transportation, in his 'Theory of Punishments:' the archbishop of Dublin's, in his two 'Letters to Earl Grey.' Their arguments may be summarily stated as follows:—1st, That transportation has failed in all experiments which have yet been made upon the principle. 2nd, That transportation necessarily involves, in reference to the country from which the criminals are sent, want of exemplarity. 3rd, That it lays a pernicious foundation for future communities. 4th, That efficient inspection is sacrificed by it. 5th, That it is more expensive than a home prison system. To these objections it is replied—1st, That transportation has not failed, but only a particular system of carrying that punishment into execution—a system which is not necessarily connected with transportation; a system which was instituted in the colonies at a time when prisons in the parent country were in the worst state possible; a system never amended in principle according to the progress of improvements in penal arrangement generally. 2nd, That in reference to the end contemplated by the word example or exemplarity, transportation is not deficient excepting in the supposition that exemplarity is an effect only of the *spectacle* of criminals enduring punishment; but in that sense, that all experience proves that, instead of preventing crimes, exemplary punishments have frightfully increased them;* that in so far as there is any real value in the principle (exemplarity) in question, it is as an indefinite, obscure source or cause of apprehension; but, that overlooking objections to the principle, in point of fact, in the sense of exemplarity as connected with the *spectacle* of punishment, that transportation is in the same situation as any home system of convict discipline, the public at large being as little the spectators of the process of the *silent* or the *separate* prison as they are of that under which transportation is carried into effect; that in the sense of general tendency to produce apprehension independently of *exhibited* punishment, it has superior recommendations to any home system. 3rd, That the objection, that transportation lays a pernicious social foundation, is made on a presumption involving the primary question which penal institutions are designed to solve, viz. that the convicts sentenced to that punishment are always to be criminal in character and habit; but that, on the contrary, the circumstances of society in a new country are economically, in the respects of high wages, abundant labour, and good prospects, much more calculated to establish and confirm the moral benefit to the character of a former criminal wrought by a good system of secondary punishment, than the circumstances of an old society in which employment is uncertain, wages low, &c.; that, besides, prejudice is always stronger against the man once fallen, and consequently more opposed to his permanent reformation, in an old and established community, than in a young, unorganized, and, so to speak, chaotic one. 4th, That experience has not proved the existence of greater abuses in the management of convicts abroad than in their management at home; and that the same provision can easily be made against abuse in connection with penal colonies as has been made in connection with prisons in the mother country (in the appointment of inspectors) within the last few years. 5th, That the question of expense, unless where the difference supposed between that of two systems is very great, is prematurely discussed, when discussed without respect to any satisfactory evidence of the greater efficiency of one than of another system. (Captain Maconochie's *Australiana*; Colonel Arthur's *Letters to the Archbishop of Dublin*; *The Merits of a Home and of a Colonial Process, of a Social and of a Separate System of Convict Management, discussed*, by F. M. Innes, 1842.)

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* The above account of the new system of convict discipline in Van Diemen's Land is unavoidably imperfect, as the system has been only very recently introduced, and no reports of its operation have been printed.

* Exposure in a state of punishment was introduced into Pennsylvania in 1786. In the year 1790, four years after its commencement, this practice was abolished, and the effect was astonishing; for at the end of another period of four years, that is to say, 1794, the population having in the meanwhile increased at the rate of four and a half per cent. per annum, and the penal law in other respects having remained unaltered, crimes had decreased by two thirds. The increase of recorded crimes after the introduction of exposure was too great and too continuous to be accounted for to any great extent by an increase of prosecutions otherwise than by reason of an increase of crimes. And no part of the subsequent decrease of recorded crimes can be so accounted for. We have remarked in this instance one fact, which seems to speak for itself enough to settle this question. The decrease of crime in the town of Philadelphia, where, doubtless, most of the exposures were made, was much greater than the decrease of crime in the county, great though that was.' p. 87-8. (*Report of the Committee on Prison Discipline to the Governor-General of India*, Calcutta, 1838.)

Hulks (*hulk*, Dutch; *hulc*, Saxon, the body of a ship), used as places of confinement and punishment for offences; corresponds with the *galea* of the Italians, the *galère* of the French, and our own English word *galley*.

History of the Hulks.—The plan of confining offenders on board hulks was adopted in England in 1776, when the disturbances in America interrupted the transportation system. The first statute authorising such confinement was the 16 George III., cap. 43, passed in 1776, for two years only, but afterwards continued by two other acts of parliament till it was repealed by the 19 George III., cap. 74, which was however founded upon the same principles with the 16th, and may be considered in part as an improved edition of that act. Confinement in the hulks under the 19 George III. was a distinct punishment inflicted by a sentence of the court before which the criminal had been tried, except in the case of offenders liable to the punishment of death, whose sentence might be commuted to imprisonment in the hulks by the crown. The offenders who might be sent to the hulks by the sentence of a court were male persons convicted of grand larceny, or of any other crime (except petty larceny) for which they were liable to transportation, and who should appear to be of fit age, and free from any bodily infirmity; and they must be sent thither (if liable to be transported for seven years) for a term not less than one year nor exceeding five years; if liable to transportation for fourteen years, they might be sent for a term not exceeding seven years. The rivers, ports, &c. at which these convicts were to be employed were to be previously approved and appointed by the crown; the officers in charge of them were to be appointed by the justices of the peace for the county in which such river, &c. should be situate, or by the justices of such adjoining county as the king in council should direct. The appointment of chaplains, surgeons, &c., was vested in the superintendents, who were to have the same powers over their prisoners as were incident to the office of sheriff or gaoler. It was also provided that the superintendents should observe, in the custody, treatment, and employment of the convicts, the direction followed by the governors of penitentiaries, so far as was consistent with the regulations specifically referring to the hulks. By the 63rd section of the act the crown might appoint a fit person to be inspector of the several vessels, who was to visit them at least every quarter, and report on their state, the behaviour and conduct of the respective officers, the treatment and condition of the prisoners, the amount of the several earnings, and the expenses attending every such place of confinement—to both houses of parliament at the beginning of every session. He was also directed, in matters of extreme or pressing necessity, to make a special report to the justices of the Court of King's Bench, who were immediately to make orders therein, and regulate or redress what required it.

The notice of parliament does not appear to have been called to the hulks between the passing of the 19 George III., cap. 74, and the year 1783, when an act was passed, the 24 George III., sess. 1, cap. 12, converting the hulks from prisons, in which criminals were to be punished by hard labour, into places of temporary confinement for convicts, between the period of their sentence to transportation and the completion of the necessary arrangements for carrying that sentence into execution. The management of the convicts was given to officers called overseers, whose powers corresponded with those of the superintendents under the former act. They were to feed and clothe the offender, and keep him in such manner, and to permit him, where the same could be safely done, to labour at such places, and under such directions, limitations, and restrictions, as his majesty or certain justices of the peace should appoint. In case the convict should receive employment, he was to be allowed half the return arising from his labour for his own use; but it was provided that no convict should be obliged to work.

The time of the offender's confinement was to be reckoned in discharge or satisfaction of the term of his transportation, as far as it might extend. Similar returns to parliament or the King's Bench were required under this as under the former act. The 24 George III., sess. 1, cap. 12, was repealed by the 24 George III., sess. 2, cap. 56, but its provisions were incorporated in this act, with the exception of those concerning the labour of the convicts, which it was provided should be compulsory. This last act was continued by various other acts till the year 1815, without any alteration in its purpose, excepting in the 28 George III., cap. 24, and the 42 George III. By the former of these it was provided that the convicts should be visited and treated as offenders sentenced to hard labour, and that the expenses occasioned by their maintenance or death should be defrayed by the overseers. By the latter the interest of the contractors was limited to that of supplying provisions, clothing, and other necessaries to be consumed in the hulks. The 55 George III., cap. 156, repealed and re-enacted by the 56 George III., cap. 27, empowers the king to appoint a person to the office of superintendent, and the persons to be deputy or assistant superintendents, also resident overseers. The latter of these acts was continued by the 1 and 2 George IV. for two years, and its provisions were then re-enacted with some variations, in the 5 George IV., cap. 34. (*Statements and Observations concerning the Hulks*, by George Holford, Esq., M.P.)

Mr. Howard frequently visited the hulks, and pointed out some of the abuses incident to their management in his book 'On the State of Prisons,' and in his account of Lazarettoes. These abuses exceeded so much those of the ordinary prisons, as to become the subject of special inquiry by a Committee of the House of Commons, in 1778. The labours of that committee led to some slight improvement in the accommodation, food, employment, and means of preserving health in the hulks. In 1785 another committee reported that the hulks, however necessary they might have been as a temporary expedient, had singularly contributed to improve the practice of villainy; that the convicts had formed distinct societies for the more complete instruction of all new-comers, who after the expiration of their sentences returned into the mass of the community, not reformed in their principles, but confirmed in every vicious habit; that when they regained their liberty no parish would receive them and no person give them work; that being shunned by their former acquaintance, and baffled in every attempt to gain their bread, the danger of starving almost inevitably led them to a renewal of their former crimes.

The act 24 Geo. III., under which the hulks were regulated for the long period of about forty years, transferred the prisoners to the custody and management of commercial contractors; and the consequences of this arrangement, formed in opposition to the most obvious principles and maxims of prison discipline, were such as might have been anticipated. The convicts were treated harshly; they were ill fed and clothed; and their moral improvement was entirely neglected. In the beginning of 1812 the complaints on these heads had became so loud as to force themselves upon the attention of government, and a Commission of Inquiry into the subject was appointed. This commission pointed out many incidental abuses, and strongly censured the system of allowing the contractors to manage the convicts by servants of their own. The fruit of its investigation was the appointment by act of parliament of inspectors. This measure did not transfer the discipline of the convicts from the contractors, the source of the greatest abuses in the hulks, nor did it involve any immediate reform whatever. In course of time however it led to some attention being paid to the health of the convicts, their supply of food and clothing, and their protection from acts of cruelty or oppression on the part of those employed in their superintendence; but in everything which affected their moral amendment no result whatever accrued from the inquiries of the commission. It was after the office of inspectors—the remedy, it has been said, which issued from the labours of the commission—had been for many years in exercise, that we find the hulks thus adverted to in a speech in the House of Commons by a member who had paid very great attention to the treatment of offenders under punishment there: 'In every hulk' (he says), 'with one exception, the prisoners on board the vessel are all necessarily distributed into three, or at most four decks, or divisions of the ship, after the hatches are closed: from this time till the convicts are let out in the morning (a period which comprehends in the winter season, in the dark days, near sixteen hours of the twenty-four) there is not among them any officer or servant belonging to the establishment; and as the decks of the ship are of very unequal sizes, more than two hundred criminals of different ages and descriptions are often thus locked in together, during this long period, to follow their own inventions, without inspection or control. . . . It appeared by the evidence of the captains of the hulks that the convicts did not dare to complain of ill treatment from each other; the captains acknowledged that they themselves could not venture to disclose the names of individuals from whom they received information of what passed among them; and so strongly was the danger of disclosure felt in one of the hulks, that it seemed to be the practice on board that hulk to inflict punishment for offences committed below, without bringing forward the informer in support of the charge. It was also evident that in some of the ships neither officers nor guards (not even the captain himself) could have gone down with safety among the convicts after the hatches were closed.' The practice of coining was carried on in some of the vessels; in others there were manufactories of skeleton keys and of indecent toys, the *materiel* of which was chiefly stolen from the yards in which the prisoners were employed. Beer was sold in the hulks by night as well as by day, with the sanction, and in some instances for the profit, of the captains. (*Speech of Mr. Holford in* 1815.)

In 1826 comparatively little improvement had been effected. Prisoners were allowed to receive money from their friends, and with it to purchase a better description of food than was allowed under the hulk regulations. 'I saw,' says Mr. Holford, in a speech in this parliament in this year, 'a few months ago on board the Justitia at Woolwich two of the convicts employed in the preparation of peppermint drops for sale in the ship; and the officer who went round with me observed that these drops were very much liked by the prisoners, being very comfortable in a raw damp morning, when they were going to work.'

From the evidence taken before a Committee of the House of Commons appointed in 1832 to inquire into the subject of secondary punishments, and before a Committee of the House of Lords in 1835, we are led to conclude that no material changes had then been effected in the discipline pursued on board the hulks.

Description of a Hulk.—The description of one hulk may not exactly correspond with that of all the others, but it sufficiently corresponds to afford a general idea. The following description refers to the Warrior convict-hulk, stationed at Woolwich. There are in this vessel three decks or floors, called the upper, middle, and lower decks. They communicate by two large openings in the centre and at the foremost end; and as these openings in each deck are placed above those on the deck below, they form a kind of tube reaching from the hold to the atmosphere above.

The main hatchways are all 4 feet 8 inches square. The fore-hatchway, upper deck, 4 feet 6 inches by 3 feet 6 inches. Middle deck, 4 feet 6 inches by 3 feet 6 inches. Lower deck, 4 feet 9 by 4 feet 8. The upper and middle decks also open into the chapel at the after end of the passages by doors 6 feet wide by 6 feet high. The chapel is a clear space 42 feet wide, 39 feet long, and 14 feet high. The habitable part of the upper deck is 84 feet long by 36 feet 6 inches wide. There are six parts on each side, measuring 2 feet 9 inches by 2 feet 4 inches. It is divided into two lateral portions by a central passage 5 feet wide. The inner boundary is a partition, consisting of iron bars reaching the full height of the deck. Each ward is subdivided by three transverse bulkheads of wood, forming eight classes, but not crossing the passage. Near the bow of the vessel are two small rooms appropriated to the sick, and an open space for the ladder and hatchways, 26 feet 6 inches in length. There are four ports in this space that ventilate the passage. There is a room at the after end of each ward, called the guards' galley, in which fires are kept till nine in the evening. These also adjoin the chapel.

The prison on the middle deck is 79 feet 6 inches long by 45 feet wide. There are seven ports on each side, four bulk-heads, and, in all, 10 classes. Width of passage 6 feet; opens into the chapel. Two small rooms are set apart as workshops. The clear space for the ladder and hatchways 19 feet 6 inches. The workshops have two ports and four large hawse-holes; open into the space forward.

On the lower deck the prison is 115 feet 6 inches long by 43 feet 6 inches wide; number of ports 15 on each side varying in size, and all smaller than the ports above. The bulk-heads are six, forming 14 classes. Width of the passage 6 feet. The space left forward is 12 feet, with four hawse-holes opening into it. From the after bulk-head to the stern-ports is a space occupied by the dark cells and store-rooms, leaving the passage free.

These prisons are rated to hold 600 men; of these 124 are disposed on the top deck, 192 on the middle deck, 284 on the lower deck; and this is effected without crowding.

Beneath the lower deck is the hold, a large and almost unoccupied space, divided into store-rooms. The central passage is 160 feet long, 32 feet high, 7 feet 6 inches wide. The openings from the hold are,—1, the main-hatch, 4 feet 8 inches square; 2, the fore-scuttle, 2 feet 9 inches by 4 feet 6 inches; 3, the after-scuttle, 3 feet by 1 foot 8 inches; 4, a small scuttle in one of the classes. M. Bossyr's *Report*; Mr. Capper's *Reports*, 1842.)

Discipline and Employment of Convicts in the Hulks.—On board the different convict-hulks a book is kept by the overseer, in which are entered the names of all convicts; and on the first Sunday of every quarter they are mustered, and the character which each convict may by his conduct during the last quarter have deserved, is marked against his name in the manner following, making known to him the character so given him at each quarterly muster:—*v. g.* very good; *g.* good; *in.* indifferent; *b.* bad; *v. b.* very bad. The convicts after they are classed are kept in separate compartments on board the ship, so far as the climate admits, and are not allowed to mix with any other class than that to which they belong after the hours of daily labour. Every prisoner is required to serve two years certain as a period of punishment without any reserve earnings, and after that time is eligible to commence a period of probation. The period of probation invariably commences when the prisoner has mustered eight times, that is, two years either good or very good. This and his subsequent character determine the duration of his period of probation. But in case of misconduct during the period of his punishment, that period is continued until he raises himself in the scale by his good conduct, so as to possess eight good musters without blemish. When a prisoner enters his period of probation, his reserve earnings commence, and continue until his ultimate liberation, subject however to be withheld for misconduct. The cells throughout the hulks are numbered consecutively, beginning from the lower deck upwards; and prisoners of the worst character, or during their period of punishment, are classed in the lower deck, and rise upwards as they progress in character, from the lower to the middle, and from the middle to the upper deck; so that the highest numbers are on the upper deck, and contain the men of best character. Whenever any convicts are allowed to earn a recompense from their labour, one-third of the earnings, that is, one penny per diem, is expended for them in the purchase of bread and vegetables, but on no account is any convict allowed to have money in his own possession: the other two-thirds is reserved until the prisoner's discharge; but in no case is such reserved earnings allowed to be given to any convict unless he has passed two years of his sentence, and then only provided his conduct has been uniformly good during the period of his confinement. If any convict at labour or otherwise misbehave himself the officers and guards are instructed to use mild and persuasive means to induce him to alter his conduct, and if these should fail, the overseer or officer in command is to punish him on board the ship, according to the nature of his crime, either by reducing his daily allowance of provisions, or by confining him in a dark cell with no other provisions than bread and water, for a term not exceeding seven days, or by mulcting him of his earnings for a term not exceeding one month, or by moderate whipping, which in any case is not allowed to exceed twenty-four stripes. The overseer or officer in command is required to make a minute in the occurrence-book of the name of the convict, the name of the complainant, the nature of the crime, and the punishment inflicted. No convict is allowed to go without an iron upon one or both legs; and those employed on board are locked up and clothed in the same manner as those employed in the yards. An overseer is required to be on the watch all night in the dormitories. Chaplains are appointed in connection with the different vessels, who are required, besides reading prayers and preaching on the sabbath and the holidays of the Established Church, to attend to the religious wants of the prisoners individually, to distribute according to their discretion the books or tracts provided for the use of the prisoners, and to take a general superintendence of the schools for their instruction. A surgeon is employed in connection with the vessels, who is required to attend to the health of the convicts, inspect their provisions occasionally, and see that the wards are properly ventilated. The employments of the convicts consist of ship-building and painting, carrying timber for this purpose, in removing chain-moorings, in cleansing the rivers on which they are employed, and in different descriptions of hard labour, and a limited number in keeping the vessels clean, preparing the food of the convicts generally, and making and repairing their clothes. Their periods of labour are from eight to nine hours and a half hour daily, according to the seasons of the year. (*Instructions to the Superintendent of Convicts in England, given at Whitehall the 22nd day of November*, 1839.)

The stations at which hulks are maintained in England are Portsmouth, Gosport, Devonport, Chatham, Woolwich, Deptford; besides Bermuda, Gibraltar is designed to be a foreign station.

The following returns relating to the hulks are taken from the latest reports addressed by the superintendent to the government:—On the 1st January, 1841, there were 3552 convicts on board the various hulks in England; and during the year, 3625 more were received into custody, besides 63 transferred from the hulks at Bermuda. Of the convicts in custody, and those received in the course of the year, in all 7240, 2374 were transported to Van Diemen's Land, 180 of whom were boys under 16 years of age; 80 were sent to Bermuda; 66 were transferred to the Penitentiary (Millbank); and 7 to Parkhurst prison: 262 were discharged; 196 died (being 2½ per cent. upon the gross number); 1 escaped; leaving 4254 convicts on board the hulks in England on the 31st December, 1841. Of the total number received, 52 were known to have been transported* before; 10 had been in the Penitentiary; 1625 had been convicted previously of various offences; 487 had been before in custody; and the remaining 1451 were not *known* to have been in prison before. Three prisoners were received during the year under 10 years of age; 213 between the ages of 10 and 15; 958 between 15 years and 20; 1612 between the ages of 20 and 30 years; and 839 who were above 30 years of age. The total expense of the hulks is represented for the year as 65,527*l.* 10*s.* 7¾*d.*, and the total value of the labour performed as 72,386*l.* 16*s.* 6*d.* (*Two Reports of John Henry Capper, Esq., Superintendent of Ships and Vessels employed for the Confinement of Offenders under Sentence of Transportation, ordered to be printed 21st March*, 1842.) The total expense per man in the hulks in England is 18*l.* 12*s.* 11*d.* The average value of labour per man is estimated at 10*l.* 18*s.* 9*d.*, making the average annual expense per man 7*l.* 14*s.* 2*d.* The total cost per boy in the hulks is 13*l.* 5*s.* 6½*d.* The value of the labour performed by the prisoners in the hulks at Bermuda is so great as to leave an estimated annual profit for each of 13*l.* 3*s.* 6*d.* (*Lord John Russell's Note on Transportation and Secondary Punishment, 8th January*, 1839.)

The hulks in England are contemplated merely as an intermediate establishment between the common gaols and the penal colonies, for prisoners sentenced to transportation; but in fact in many cases they prove a substitute for that punishment. They are deemed to constitute the worst branch of secondary punishment known in England, and their discontinuance has been more than once advised.

Prisons (*Prison*, French), places of safe custody, of punishment, and reform.

History of Improvements in Prisons.—The history of modern improvements in the prisons of this country begins with the labours of Mr. Howard in the last century. In the first section of Mr. Howard's book on 'The State of the Prisons in England and Wales,' which he entitles 'A General View of the Distress in Prisons,' published in 1775, he presents a summary of the abuses which existed in the management of criminals at that time. Beginning with food, he states that in several bridewells there was no allowance of food at all; in some, the keeper farmed what little was allowed to the prisoners, and where he engaged to supply each prisoner with one or two pennyworth a day, it was known to be shrunk to a half and sometimes less than a half the quantity. In answer to the question, does not their work maintain them? he says, that there were few bridewells in which any work was or could be done. The prisoners had neither tools nor materials of any kind, but spent their time in sloth, profaneness, and debauchery to a degree which was shocking. In the county gaols, debtors had no bread, although it was granted to the highwayman, the housebreaker, and the murderer; and medical assistance, which was provided for the last, was withheld from the debtor. In many of these gaols, debtors who would have worked were not permitted to have any tools lest they should furnish felons with them for escape or other mischief. Mr. Howard next remarks the deficiency of water in many prisons: many (he says) had no water; in some places where there was a supply, prisoners were always locked up withindoors, and had no more than the keeper or his servants thought fit to bring them. Of the want of ventilation he gives this striking illustration: 'My readers will judge of the malignity of the atmosphere when I assure them that my clothes were in my first journeys so offensive, that in a post-chaise I could not bear the windows drawn up, and was therefore often obliged to travel on horeback. The leaves of my memorandum-book were often so tainted, that I could not use it till after spreading it an hour or two before the fire; and even my antidote, a vial of vinegar, has, after using it in a few prisons, become intolerably disagreeable.' Some gaols at this time had no sewers; and in those that had, they were occasionally offensive beyond expression. In some instances the gaolers had to pay the window-tax, which tempted them to stop the windows, thereby stifling their prisoners. There was no allowance of bedding or straw in many gaols and most bridewells; and if by any chance a little was obtained, it was not changed for months together, so that it was almost worn to dust. Some of the prisoners lay upon rags, others upon bare floors.

The evils which have been mentioned related to the health of prisons: in reference to morals a catalogue equally striking follows. All sorts of prisoners were confined together; debtors and felons; men and women; the young beginner and the hardened offender; and with all these, in some counties, such as were guilty of misdemeanors only, who should have been committed to bridewell, but who, for the want of food and the means of procuring it there, were in pity sent to such county gaols as afforded the prisoners an allowance of food. In some gaols were confined idiots and lunatics, who served for sport to idle visitants at assizes and other times of general resort. The insane, where they were not kept separate, disturbed and terrified other prisoners.

The consequence of neglect of air, food, and water, was a fever called the Gaol Fever, by which, in 1773-4, Mr. Howard, from his own observations, remarks, that more were destroyed than were put to death by all the public executions in the kingdom,—which, at a time when the punishment of death was inflicted for one hundred and sixty different offences, was a very great number.

Of the indiscriminate association of idle criminals, the results as mentioned by Mr. Howard need scarcely be quoted: petty offenders committed for short periods generally grew desperate, and came out fit for the perpetration of any villainy. 'I scruple not,' are the words of Mr. Howard, 'to affirm, that half the robberies committed in and about London are planned in the prisons by that

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* This means, had been in the hulks before.

dreadful assemblage of criminals and the number of idle people who visit them.'

In another section of the account from which the foregoing extracts have been taken, bad customs in prisons are referred to. Of these is mentioned a cruel custom of demanding of a new prisoner garnish, footing, or (as it was called in some London gaols) chummage. 'Pay or strip, are the fatal words. Fatal (repeats Mr. Howard), for they are so to some, who, having no money, are obliged to give up part of their scanty apparel; and if they have no bedding or straw to sleep on, contract diseases which prove mortal. The prisoners in gaol previously make an addition to the garnish paid by the new-comer; and the following night is spent in riot and drunkenness.' Gaming in various forms was very frequent; cards, dice, skittles, Mississippi and Portobello tables, billiards, fives, tennis, &c. There was scarce a county gaol that was not furnished with them, and prisoners were continually at play.

Prisoners were loaded with heavy irons by night as well as by day; and in some county gaols the women did not escape this severity.

The remuneration allowed to many of the gaolers consisted wholly or partially in the profits derived from selling beer and spirits to the prisoners. Some gaols were private property, the governors of which were not responsible to any magistrate; they allowed the prisons to go out of repair, and used the most objectionable means to secure the detention of those under confinement. Mr. Howard mentions one of these gaols, where the proprietor tortured the prisoners with thumb-screws. The grand jury took up the case, and remonstrated to the gaoler, but in vain.

All the vices thus generally stated, nearly throughout in Mr. Howard's words, are illustrated by him in reference to particular prisons.

The labours of Howard, and of those who, inspired by his example, united in seeking to effect an amelioration in the penal institutions of the country were but slowly attended with success. Nearly fifty years after the date of the above details the Prison Discipline Society remark, that there yet exist many prisons in the same condition as that in which Howard left them—monuments of the justice of his statements, and of the indifference with which his recommendations had been regarded. (*Fifth Report*, p. 16.) In 1818 it appears by parliamentary returns, that out of 518 prisons in the United Kingdom, to which upwards of 107,000 persons were committed in that year, 23 prisons only were classed or divided according to law; 59 prisons had no division whatever to separate males from females; 136 had only one division for that purpose; 68 had only two divisions, and so on; 23 only being divided according to the regulations of the statute (24 George III., c. 54, sect. 4) which provides for eleven. In 445 prisons no work of any description had been introduced; in 73 prisons, though some work was performed, yet the number was exceedingly small in which employment to any extent had been carried on. In 100 gaols built to contain only 8545 prisoners, there were at a time 13,057 persons confined. The practice of using fetters to prevent the escape of the prisoners continued in force in many gaols; and one is specified in the 'Report' of the Prison Discipline Society for 1823 (pp. 19, 20), where those charged with felonies were on their first reception double-ironed; and, thus fettered, were at night chained down in the bed, the chain being fixed to the floor of the cell and fastened to the leg-fetters of the prisoners. This chain was of sufficient length to enable the prisoner to raise himself in bed; his cell was then locked, and he continued thus chained down from seven o'clock in the evening until six the next morning. As there were in the county in which this abuse existed but two gaol-deliveries in the year, a prisoner might continue to be thus treated for six or eight months, and be then acquitted as innocent on his trial: the double-irons thus used on the untried prisoner varied in weight from 10 to 14 pounds.

It would be impossible to point out with any degree of minuteness, in a limited compass, the successive steps in prison improvement, and to fix their date. Without therefore attempting to trace the progress of changes which were introduced partially and irregularly, not generally or simultaneously, throughout the prisons of the country, as a first step in the attempt to effect improvement in convict arrangements may be mentioned the introduction by law of classification.

Classification of Offenders.—The argument of those who wished to make the experiment of classifying prisoners is thus succinctly stated by a distinguished American writer on penal jurisprudence:—'That, as a place of punishment, a prison would soon lose its terrors if its depraved inmates were suffered to enjoy the society within, which they had always preferred when at large; and that, instead of a place of reformation, the prison would become the best institution that could be devised for instruction in all the mysteries of vice and crime, if the professors of guilt were suffered to make disciples of those who may be comparatively ignorant. To remedy this evil therefore we must resort to classification: first, the young must be separated from the old; then we must make a division between the novice and the practised offenders. Further subdivisions however were found indispensable, in proportion as it was discovered that in each of these classes there would be found individuals of different degrees of depravity, and of course not only corrupters, but those who were ready to receive their lessons. Accordingly, classes were multiplied, until in some prisons in England we find them amounting to fifteen or more.' The same writer exposes the fallacy of this argument in what follows:—'But in the consideration of this question these evident truths seem not to have had their proper force: first, that moral guilt is not the immediate subject of human observation; nor, if discovered, is it capable of being so nicely appreciated as to enable us to assign to each individual who may be infected with it his comparative place in the scale; and if it could be discovered, it would appear that no two individuals could be found contaminated in the same degree: secondly, that if these difficulties could be surmounted, and a class formed of individuals who had advanced exactly to the same point, not only of offence, but of moral depravity, still their association would produce a further progress in both.' (Livingston's *Penal Code for the State of Louisiana; Introductory Report to the Code of Reform and Prison Discipline*, p. 309.) In illustration of the correct reasoning of this passage, the following extract from the evidence of a Middlesex magistrate is quoted:—'Classification might in some measure be obtained, certainly; but men are frequently convicted of a trifling offence, and sentenced, who have been previously guilty of a very heavy crime. As an instance of this, in a prison where classification is attempted, I recollect a man who was tried for cutting off the head of his child, and placing it on a table to meet his wife's view when she returned into the room, and where he merely escaped the punishment of death by a technical difficulty. I saw this man a few days afterwards as a misdemeanant, among the trifling offenders.' (q. 1784, *Evidence of Samuel Hoare, Esq.; Select Committee of the House of Commons*, 1832.) Classification continues to be the leading principle of arrangement in many prisons; in others the object contemplated by it, namely, the prevention of contamination, is further sought by the prohibition of oral communication between the prisoners.

Prisons on the Silent System.—Of the prisons which have been subjected to any fundamental changes during the last twenty years, the greater number are conducted on the *silent* system. By the advocates of this system it was supposed, as we have said, that contamination would be prevented by the intercourse of the tongue being prohibited. The first objection incurred in carrying out this plan was the great expense of employing a requisite number of officers to enforce silence. To mitigate or get rid of this objection, another, and perhaps a greater evil, was produced by the introduction of the practice of giving to prisoners a control over other prisoners. In Coldbath Fields prison, containing on an average 900 prisoners, no less than 218 were, in 1837, removed from the operation of the law and the endurance of their punishment by being appointed to offices of trust or control. Besides these 218 there were 54 regular officers; so that 272 persons were appointed to superintend 682 prisoners (*i. e.* 900 minus 218, who had appointments), being in the ratio of one officer to 2½ prisoners. With all this wasteful superintendence, involving so entire a sacrifice of discipline, the great object of prisons on the principle of Coldbath Fields was not attained. 'The minds of the prisoners (say the Inspectors of Prisons in their Report for that year are kept under perpetual irritation by the prohibition of speech, their ingenuity at work to find means of evading it, and they are still further depraved by frequent subjection to punishment for an offence of a merely arbitrary character.' In illustration of the amount of punishment inflicted in prisons on the silent system, for breach of regulations merely, the Inspectors quote the following returns:—

	Number of Punishments for Offences within the Prison in the course of the year.		Number of Prisoners in the course of the year.	
	Males.	Females.	Males.	Females.
Coldbath Fields House of Correction	11,428	2,384	6,625	3,125
Wakefield House of Correction . .	10,822	1,623	2,860	578
Salford House of Correction . . .	3,792	389	5,447	2,310
Knutsford House of Correction . .	1,265	85	1,168	281
Stafford Gaol and House of Correction	188	44	2,046	231
Westminster Bridewell.	3,532	1,316	3,085	2,439
Brixton House of Correction . . .	898	273	2,167	1,118

For 'talking and swearing' alone, in Coldbath Fields House of Correction, in 1836, the punishments averaged about 12 per diem; but even these large returns fall short of being a correct index of the discipline. The punishments generally imposed consisted in reduction of food, or confinement in solitary cells, by which health was so much impaired, that the governors were obliged to reduce the severity to a degree which impaired its efficacy. From this discretion interposing between the discipline contemplated and the means required for its enforcement, arose a great disproportion in the amount of punishments in the different prisons on the silent system. In Coldbath Fields House of Correction, with nearly three times the number of prisoners in Wakefield House of Correction, the punishments (in 1837) were nearly equal in amount, exceeding 1000 per month. In Brixton House of Correction, with nearly the same number of prisoners as in Wakefield, the number of punishments were not one-tenth in amount. In Stafford House of Correction, with about two-thirds the number of prisoners as in Wakefield, the punishments were not one-fiftieth in amount. In Tothill-Fields House of Correction, with one-fourth more prisoners than in Wakefield, the punishments were little more than one-third in amount. In Salford House of Correction, Lancashire, with more than twice the number of prisoners in Wakefield, the punishments were only one-third in amount. (*Report of the Inspectors of Prisons*, 1838, pp. 166-7.)

The recommittals to Coldbath Fields prison (the largest prison in the kingdom on the silent system) for the year ending September, 1836, were 2795; to Westminster Bridewell, the proportion ascertained to the recommittals was about 40 per cent., and the real proportion was probably much larger. (*Inspectors' Report*, 1837.)

Since the date of the returns quoted, the employment of prisoners as wardsmen, and in other incidental capacities, has been to a great extent abolished, and an approach has been made to uniformity in the discipline pursued in prisons on the *silent* system. But under any arrangements the principle on which such prisons are conducted almost necessarily involves great and numerous vices.

Regulation of Prisons on the Silent System.—The power of establishing rules for prisons is vested by act of parliament (5 & 6 Wm. IV., c. 38) in the secretary of state for the home department. Distinct divisions of each prison are appropriated to male and female prisoners. The several wards, cells, yards, &c. are devoted to distinct classes of prisoners. There are baths for the cleansing and bathing of prisoners; a fumigating oven for the cleansing and disinfecting of their clothes, linen, or bedding. A competent number of cells adapted to solitary confinement for the punishment of refractory prisoners, and for the reception of such as may by law be sentenced to confinement therein, is provided. Separate rooms are provided as infirmaries or sick wards for the two sexes, and as far as possible for the different descriptions of prisoners. Every prisoner is provided with suitable bedding, and every male prisoner with a separate bed, hammock, or cot, either in a separate cell, or in a cell with not less than two other male prisoners. Convenient places are set apart for washing, combing, &c., and yards for exercise. It is provided by law that the visiting justices appointed at each quarter-session shall meet periodically at the prison and inspect the several journals, registers, and books, and give such directions as may to them seem necessary; that they shall regulate a scale of fines to be levied by the governor upon the subordinate officers for negligence in the performance of their duties; that they may suspend any officer; examine from time to time the state of the buildings, the classification, separation, inspection, hard labour, employment, health, diet, instruction, &c. of the prisoners; also into the amount and disposal of their earnings, the expenses attending the prison, and any improvement which may be practicable; they are required to direct such books as they think proper to be distributed for the use of prisoners who do not belong to the established church; they may enter into contracts for the employment of prisoners in any work or trade within the prison, subject to the sanction of the general or quarter session; they may authorize any prisoner to be employed in the service of the prison, but not in the service of any officer in control or instruction of any other prisoner; they may order necessary clothing or tools to be given to any prisoner on his discharge, or may pay his passage home, or present him with such a moderate sum of money as they may think fit: they are required to make a report respecting the state of the prison at every quarter-sessions: in case of contagious disease, or any other emergency, they are empowered to issue an order under their hands and seals, to remove the prisoners to some other prison or place of confinement within their jurisdiction; in case of any criminal prisoner being guilty of repeated offence against the rules of the prison, or of any greater offence than the governor is authorized to punish, a visiting justice may order the offender to be punished by solitary confinement; and in case of absolute necessity, by confinement in irons; a visiting justice may receive the complaint of any prisoner. Spirits, wine, beer, and tobacco are prohibited to any prisoner excepting in cases approved of by the surgeon. For every prison it is provided that there shall be a governor, chaplain, and surgeon; and for the female branch of the prison a matron; and a sufficient number of schoolmasters and mistresses, male and female turnkeys, and subordinate officers; none of whom, excepting the chaplain and surgeon, are allowed to hold any office or have any occupation except what refers to the prison. The governor is required to reside in and never to be absent from the prison without the deputy-governor being invested with his powers; nor at night, without permission in writing from a visiting justice. He is required to keep a journal for recording all punishments inflicted by his authority, or by that of any justice, with the cause thereof: he must, as far as practicable, visit every ward, and see every prisoner, and inspect every cell once at least in twenty-four hours; or in case of his omitting to do so, must state the cause of the omission in his journal: he must also from time to time, at an uncertain hour in the night, go through the prison. Before any prisoner under twenty-one years of age is discharged, he must inform the friends or relatives of such prisoner, that they may have an opportunity of receiving him: he must hear all complaints against or by prisoners; and he may punish by solitary confinement, by diminution of food, or by the substitution of bread and water for the usual allowance, any prisoner guilty of offence: he must inspect every letter and parcel to and from prisoners (excepting such as are addressed to a visiting justice, or other proper authority). The chaplain must be a duly licensed clergyman of the Church of England: he is required to read prayers daily, perform divine service on Sabbath and church holidays, administer the sacrament to prisoners whose state he may deem fitting for that ordinance; devote a certain portion of time daily to the prisoners, noting the hour at which his labours commence and close, in a journal to be kept by him; must frequently visit the infirmaries and sick; attend at all reasonable times any prisoner who may require spiritual advice and assistance, paying especial attention to juvenile offenders and to prisoners in solitary confinement; he must superintend the distribution of books, and also the management of schools; at every Michaelmas quarter-sessions deliver to the justices a written statement as to the religious and moral instruction and condition of the prisoners, with observations thereon. Should any prisoner be of a different persuasion from that of the Established Church, a minister of such persuasion, at the request of the prisoner, at reasonable times, and under restrictions imposed by the visiting justices, is allowed to visit him. The surgeon is required to visit the prison daily, and oftener than once, if necessary, and to see every prisoner confined therein at least twice in the week. His directions to provide improved diet, air, exercise, &c. for any prisoner who is an invalid must be attended to. Whenever he has reason to apprehend that the mind or body of a prisoner will be injuriously affected by the discipline of the prison, he is required to report such case in writing to the governor: he must occasionally inspect the various parts of the prison, see to the proper distribution of the thermometers, take notice of the provisions supplied for the prisoners, and also of the bedding; and upon these particulars he is authorized to report to the governor or visiting justices; he must keep a record of the state of health among the prisoners, or to report in writing after any death the circumstances under which the deceased was brought under his treatment, the progress, &c. of his complaint; in case of necessity he may call in additional medical assistance; he must attend at the infliction of all corporeal punishments, and his orders for preventing injury to health must be obeyed; no prisoner labouring under acute or dangerous distemper must be discharged from prison unless such prisoner desire it.

On entering the prison all prisoners must be placed in a reception cell; be examined and strictly searched: all property taken from them, and entered in an inventory book, such property being returned on their discharge. Every prisoner must be examined by the surgeon, and after examination cleansed in a warm or cold bath, and have his hair cut, before being passed into the proper ward. Male prisoners may be visited by their friends in the presence of the governor or a subordinate officer; female prisoners in the presence of the matron or other female officer. No prisoner who is a Jew or a Mohammedan is compelled to labour on his Sabbath.

A different dress is worn by a prisoner convicted of felony from one convicted of a misdemeanor: he is employed, unless prevented by sickness, at such hard labour as can be provided, aud for so many hours (not exceeding ten) daily, except on Sundays, Christmas, Good-Friday, or any public fast or thanksgiving day. Some descriptions of misdemeanants are allowed to wear their own clothing if deemed sufficient and proper; they are allowed to maintain themselves, and receive at reasonable hours any food, clothing, bedding, or other necessaries, under the control of the visiting justices; they may receive the visits of their friends at any hour between nine in the morning and six in the evening, in the presence of an officer of the prison; they are allowed the use of wine or malt-liquor in limited quantities, and snuff; they are not required to perform any work or labour, clean their own apartments, make their beds, or discharge any menial office. In chapel seats are provided for them apart from prisoners of any other class or division. Should any prisoner of this description be unable to maintain himself, he is provided with such a diet as any two or more visiting justices direct. Prisoners convicted of felony, but not sentenced to hard labour; prisoners convicted of misdemeanour, who do not come under the description contemplated in the above detail; and other convicted prisoners not sentenced to hard labour—must be clothed in a particular dress, and employed in some work or labour which is not severe; and they are restricted to a prison diet. They are required, like all other prisoners, excepting misdemeanants of the first division, to preserve silence. ((*Rules and Regulations for the Government of Westminster Bridewell, as certified by the Secretary of State for the Home Department*, 17*th June*, 1841; *Regulations for Prisons in England and Wales*, 1840.)

Prison Labour.—Tread-wheel.—Crank-Machine.—The labour which is most generally imposed in prisons conducted on the silent system is that of picking oakum, and of the tread-wheel. The first needs no explanation; the second may not be understood without it. The tread-wheel is similar to a common water-wheel. Upon its circumference are stepping-boards of sufficient length to allow standing-room for a row of a given number of persons. The weight of those persons—the first moving-power of the machine—produces the greatest effect when applied upon the circumference of the wheel at or near the level of its axle. To secure therefore this mechanical advantage a screen of boards is fixed up in an inclined position above the wheel, in order to prevent the prisoners from climbing or stepping up higher than the level required. A hand-rail is fixed upon this screen, by holding which they retain their upright position upon the revolving-wheel, and the risk of injury is lessened. A light shed protects the prisoners in wet weather, and, from the heat of the sun in summer, and it is generally so constructed as to expose all who are employed on the wheel to the inspection of the overseers. The tread-wheel is set to work in the following manner:—The party of prisoners ascend at one end by means of steps, and when the requisite number are ranged upon the wheel, it commences its revolution. The effort to each individual of the party is simply that of ascending an endless flight of steps, the combined weight of the prisoners acting upon every successive stepping-board, precisely as a stream of water upon the floating boards of a water-wheel. This operation is maintained without intermission during the hours of labour, by the appointment of a certain portion of the class to relieve the party on the wheel. These changes are performed at regular intervals determined by signal: when the prisoner at one end of the wheel descends for rest, another at the same moment ascends at the other end. By this method the proper number of men on the wheel is continually kept up, and the work is equally apportioned to every man. The degree of labour to each prisoner in a given time is also determined by regulating the proportion of working and resting men one to the other; or, which amounts to the same thing, the relative proportion of those required to work the wheel to the whole number of the class: thus, if ten out of fifteen men are appointed to be on the wheel, each man will have forty minutes labour and twenty minutes rest in every hour. In the application of exertion to this species of labour, there are two objects to be considered in the measurement of such exertion: first, the rate with which the exertion is maintained; secondly, its duration. The rate of exertion maintained by a prisoner on the tread-wheel is determined by the velocity of its revolutions, and by the height of the steps: thus, if a prisoner treads upon the steps of a wheel which are eight inches asunder, and if the velocity of the revolution be fifty steps per minute, he will have to move or lift his own weight over 33⅓ feet per minute, or maintain a rate of exertion equal to 2000 feet of ascent per hour. To complete the measure of individual labour the duration of this rate of exertion is next to be considered. This will be affected by the proportion of resting and labouring prisoners, in which a class or gang is appointed to work on a tread-wheel, and by the number of hours which the regulations of the prison require for daily labour. Thus where two-thirds of a class are appointed to be on the wheel, and one-third to be off the wheel as relays, and when the number of hours of general labour for the day are 10, the duration of actual labour will be 6⅔ hours. Then, if the rate of exertion, 2000 feet per hour, be multiplied by 6⅔, we have a result of 13,333 feet ascent as the measure of each man's labour at the wheel for the whole day. The labour of the tread-wheel is at present chiefly applied to the grinding of corn and pumping water for prison consumption. (See *Description of the Tread-mill for the Employment of Prisoners, with Observations on its Management, published by the Committee of the Society for the Improvement of Prison Discipline, &c.*

In some prisons females as well as males are employed on the tread-wheel, the application of this mode of punishment to either or both of the sexes being determined by the discretion of the justices of the peace in connection with each prison. In Coldbath-Fields prison females are so employed, whereas in Westminster Bridewell they are not. The application of tread-wheel labour to women is liable to occasion miscarriage in cases of pregnancy, and in various ailments of the sex it is apt to produce serious disease: it is injurious also to males when applied for a prolonged period. As a punishment it is very unequal, its severity depending upon the physical strength of those subjected to it; and it is administered with great want of uniformity in different prisons, as the following table will show:—

Houses of Correction.	Average Number of Working Hours per Diem.	Height of each Step.	Ordinary Velocity of Wheels per Minute.	Ordinary Proportion of Prisoners off the Wheel, to Total Number employed.	Average Number of feet in ascent per Diem.
		Inches.	Steps.		
Walsingham .	7	8	36	2/7	7,799
Northampton .	6½	7	48	¼	10,920
Coldbath-fields	7¾	8	48	⅓	16,800
Petworth . .	8½	9	48	¼	18,473
Knutsford . .	8¾	8¾	48	⅓	21,000

(See *Digest of Gaol Returns, No.* 6; *Appendix to the Report of the Inspectors of Prisons*, 1837.)

Another mode of employing prisoners, but one which is not so much in use as the tread-wheel, is with the crank.

This machine, which is intended for providing labour for prisoners in solitary cells, is contained in a strong cast-ron case; the height is about 3 feet 6 inches; breadth nearly 2 feet, and the thickness about 18 or 20 inches. The fly-wheel belonging to it is about 4 feet in diameter. The crank is made of wrought-iron, not less than 2¼ nches square in the centre, and a proportionate strength at the ends, on which is fixed the fly on one side, and the crank for the labour of the prisoner at the other; a connecting-rod is attached to the crank, with strong steel oints, and a brass pulley or sheave on sliders to preserve a parallel motion to the pump-rod moving through the stuffng-box. The pump is a brass cylinder bored very corectly, and about 2 or 2½ inches diameter, and 10 or 12 nches long.

The cistern is a vessel made of strong copper, and will contain about four or five gallons of water or any other luid. The air-vessel is also made of strong copper, about ¼ inches in diameter and 12 inches in length, conneeted by a strong lead pipe with the pump and cistern. To this pipe is fixed a brass valve, which is covered to prevent he water or other fluid from spraying about. This valve, and the rod connected with the valve, is loaded with a ever and weight, and by shifting the weight the degree of abour is varied.

When the crank is put in motion by the prisoner, the water is received into the pump, a part is forced into he air-vessel, and part through the valve into the cistern whence it was taken: this produces a continued round of hard labour for any length of time. The crank is generally provided with a gyrometer (γῦρος, a circle, and μέτρον, a measure), which calculates the exact number of urns made by the prisoner in the week, at the rate of from 20,000 to 25,000 turns per day, or from 45 to 50 turns per minute, for any number of working hours. The machine s very closely shut from the prisoner; and at any time when the superintendent desires to examine the labour done by the prisoner, he unlocks the circular door, and the gyrometer at once points out the number of turns that have been made. The rising bottom to the cistern is made with very small holes, to prevent any substances passing nto the pump. The prisoner stands on a step of wood to work, which makes him a proper height for the crank, which should be about 2 feet 6 or 8 inches above his standng-place. The crank-machine may be constructed of different sizes. Plans will be found in the work from which we quote, which will render the above description more inelligible. (*Description of the Tread-Mill, and of the Portable Crank-Machine by Wm. Hase.*)

Expense of the Silent System.—The average expense of each convict kept in a House of Correction, on the silent system, is about 55*l*. or 56*l*. for four years. (Lord John Russell's *Note on Transportation and Secondary Punishments*, January 2, 1839.)

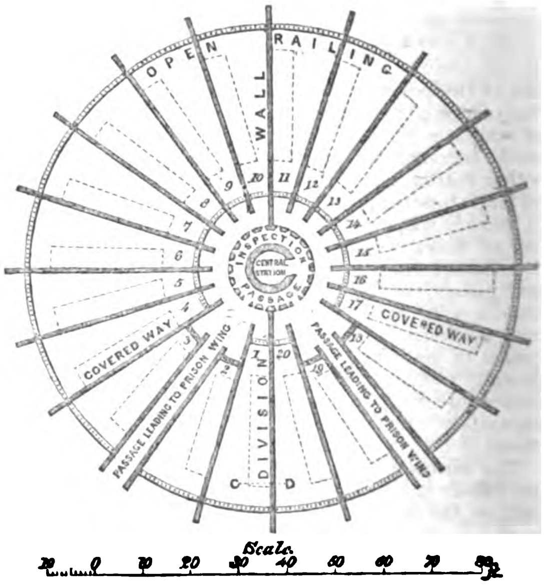
Separate System.—Separate imprisonment differs from what is ordinarily understood by solitary imprisonment in the following particulars:—'In providing the prisoner with a arge, well-ventilated, and lighted apartment, instead of mmuring him in a confined, ill-ventilated, and dark cell; n providing him with everything that is necessary to his cleanliness, health, and comfort during the day, and for his repose at night, instead of denying him those advantages; n supplying him with sufficient food of wholesome quality, instead of confining him to bread and water; in alleviating his mental discomfort by giving him employment; by the regular visits of the officers of the prison, of the governor, surgeon, turnkeys, or trades' instructors, and particularly of the chaplain, instead of consigning him to the torpor and other bad consequences of idleness, and the misery of unmitigated remorse; in separating him from none of the inmates of the prison except his fellow-prisoners, instead of cutting him off as far as may be from the sight and solace of human society; in allowing him the privilege of attending both chapel and school, for the purposes of public worship and education in class (securing on these occasions his complete separation from the sight and hearing of his fellows), instead of excluding him from divine service and instruction; in providing him with the means of taking exercise in the open air, whenever it is necessary and proper, instead of confining him to the unbroken seclusion of his cell.' (*Inspectors' Report*, 1838.) It is contended by the advocates of the separate system that as a mode of punishment it prevents contaminating intercourse among criminals, without requiring for that purpose the addition of those punishments which are attached to breaches of regulation in prisons on the silent system; and that it obviates the necessity of that minute supervision by prison officers likewise characteristic of the silent system, and which, in its operation, is found to be humiliating and degrading without being effective: that it diminishes the probability of a prisoner being recognised after his restoration to society as having been the subject of penal infliction, and thereby favours his permanent reformation; that it presents the mind of the prisoner in the most favourable circumstances for receiving new and right impressions; that it does not disturb these impressions in their progress to becoming settled habits; that labour being given as a mitigation, not an aggravation, of confinement, in a separate cell, it is ever afterwards associated in the mind with what is agreeable, instead of with what is degrading and repugnant, as in the case of those prisons where it is imposed as a punishment.

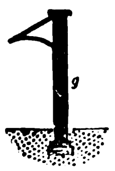
By the opponents of the separate system the compatibility of the enforcement of that system with the maintenance of the sound state of body and mind of the prisoners has been questioned. The assumption that all association of criminals must necessarily be degrading has been disputed; and it has been urged that it is the object for which men are associated, and the principles by which their association is regulated, not the original character of the individuals brought together, which determines the effect of this association on the individuals. Accordingly it has been contended that while it may be perfectly true that association for exemplary or vindictive punishment is deteriorating, it remains to be proved that association for reform would be so; and it is further contended, that in a process contemplating reform, success will be aided by association, as in the case of societies for the promotion of temperance and the like. In reply to the argument respecting the recognition of the criminal after release, it is said the argument may be allowed all its assumed weight if it can be shown that, consistently with justice, the conviction of an offender may take place without the knowledge of more than the parties immediately concerned in his prosecution, or that his release will not involve a renewal of any of the connections of place or person which subsisted before imprisonment. That solitude is favourable to the inculcation of new principles is allowed, but it is urged that the cultivation of principles in the mind is only one-half of a process of conversion, and that without a sphere of action they can neither be matured nor satisfactorily tested. These and other objections have been urged by writers to whose works the reader is referred; but it is generally agreed that a satisfactory determination of the question at issue can only be derived from experiments, to enter on which there is less reluctance, seeing that every mode of secondary punishment which has yet been tried has disappointed the expectations in which it originated. (*Australiana, or Thoughts on Convict Management*; and *A General View of the Social System of Convict Management*, &c., by Captain Maconochie; *The Merits of a Home and of a Colonial Process; of a Social and of a Separate System of Convict Management*, by F. M. Innes; *Reports of the Inspectors of Prisons*.)

The separate system originated in this country in the year 1790, and was first tried in the county gaol, Gloucester. This building was provided with cells in which prisoners were confined apart, day and night, from the hour of admission to that of discharge. Those confined under short sentences were denied, those under long sentences were provided with, employment. Moral and religious instruction was given in the cells and in the chapel. This discipline was enforced during seventeen years, in which period there were very few re-commitments. But the increase of population demanding increased prison accommodation, the system was abandoned to make room for additional prisoners. In 1811 the favourable opinion conceived of separation in prisons by a committee of the House of Commons led to a recommendation 'that a separate prison should be erected in the first instance, for the counties of London and Middlesex, and that measures should be taken for carrying on the pentitentiary system, as soon as might be practicable, in different parts of the country.' In the following year (1812) the act 52 Geo. III., c. 44, was framed in conformity with the committee's recommendation, by which act the Penitentiary at Millbank was commenced in 1813—subsequent acts granting leave to increase its accommodations. In 1821 this great prison was completed for the reception of 1200 hundred convicts, for England, Scotland, and Wales. The separate system did not begin to be carried out for some years after the establishment of the Millbank Penitentiary, and after having been for some time in operation it was abandoned, owing to the great mortality which prevailed there. This mortality, it is alleged, resulted from the unhealthiness of the situation in which the Penitentiary is built, and all connection of it with the separate system, in the nature of a consequence, is denied. (*Inspectors' Reports.*)

A model prison on the separate system has just been completed, and no less than 14 more are projected in different parts of England; the success or failure of which will determine whether the system shall, or shall not, become general. The following are the general principles observed in the construction of the model or Pentonville prison, London:—

Separate Prison Construction.—The boundary-wall is of a height above the ground sufficient to preclude all chance of escape by climbing, and the foundation of such a depth as to prevent undermining in the course of a single night. It presents an even smooth surface on both sides. A clear space is preserved on the outside of the boundary, that no erection may be made against it, and that the exterior may be open to inspection; and in like manner the prison wings are not connected with it, but a clear space preserved round the interior. There is only one gateway in this external boundary, which is placed immediately opposite the entrance-door, opening into an inclosed court-yard. The gate being retired a little, it is deemed will be of advantage in affording the means of defending it through loop-holes made in the side-walls, should attempts be made to force it during riots or popular excitement. Accommodation is provided within the prison walls for the officers in detached houses. The prison is entered by a broad passage leading through the entrance-building to the central hall, on the sides of which there are convenient apartments for the turnkey, male and female superintendants, and surgeon; and a mess-room for the officers, together with a room for the magistrates, and an office for the governor: these last rooms look into the central hall, and command a view of the interior of the prison: there are likewise staircases leading to the basement, infirmary, and chapel. The basement of the entrance building contains reception cells, a cleansing-room for males, a fumigating oven for disinfecting prisoners' clothes, store-rooms for clothing and prison stores, such as bedding, &c., water-closet, and a room for the steward or prison officer employed about the kitchen and store departments. A portion of the upper part of this entrance building is appropriated as a chapel, and the remainder as an infirmary, or convalescent rooms; the former opening into the central hall, and the latter entirely detached from the rest of the prison by a partition wall, being a separate staircase from the passage below. The central hall, as before explained, opens from the floor to the roof, and will be used as the principal station of the officers engaged in carrying on the discipline of the prison. A gallery, which is a continuation of that into which the prison rooms or cells open, runs round the central hall about 10 feet above the floor, affording access to the chapel and all the wings; staircases being placed in convenient situations communicating with it. The windows of the hall overlook the airing-yards, and the greater part of the space within the boundary wall. The general kitchen of the prison, the bread-room, scullery, coal-cellar, and an apparatus for cooking, and for ventilating and warming the entrance building, are situated in the basement under the central hall and a small portion of the adjacent wings. The prison wings, as before explained, radiate from the central hall, an open passage or corridor being designed to run longitudinally through the centre of each, and the prison rooms or cells open into the corridor; these being ranged in three stories. The lower range is on the level of the floor of the corridor and hall; the upper ranges open upon a narrow gallery attached to the wall, which is continued round the central hall as already explained. At the farther extremity of each prison wing a flight of steps, covered by a trap-door, lead to the punishment cells, which are placed in the basement. In the centre of each wing a circular iron staircase is designed to communicate with the galleries, and to be continued into the store-rooms below. In addition to the stores and ventilating apparatus, placed in the basement under the centre of each prison wing, is a large bath, the use of which it is conceived will be essentially conducive to the health of the prisoners. The general dimensions of the cells are about 13 feet long by 7 broad, 9 or 10 feet high, to the under side of the arched ceiling. It is deemed desirable that the length should greatly exceed the breadth, as this affords a better opportunity of taking exercise, and facilitates the unobserved inspection of the interior. The partitions between the cells are not less than 18 inches in thickness, thereby precluding as much as possible the transmission of sound between adjoining cells. The external walls are two bricks and a half thick, or two feet of stone; the internal walls next the corridor or passage two bricks thick, or 18 inches of stone; the flues are 12 by 5 inches, and are worked in the corridor wall and the external wall for ventilation. The windows of the cells are placed close under the arch, and have stone sills. The iron window-frame is a fixture let into a groove, with proper rebates for the glass, which is unpolished: the general dimensions of the windows are about 3 feet 6 inches long and not exceeding 11 inches in breadth. For additional security a strong wrought-iron bar is placed outside the window-frame, in the direction of its length, so as to divide the opening into two portions of about 5 inches each. The cells have single doors, the frame of which is of oak, 6 inches by 5; the doors, 2 inches thick, of deal, framed flush on both sides, the edges covered with felt, to prevent noise in the transmission of sound; a strong iron plating is on the side next the cell, riveted through; and the doors are hung with strong 4½-inch butt hinges, and fastened with a spring lock and latch; a bevelled aperture is cut for the inspection slide, and a trap-door, 6 by 9, is fixed in the door for passing provisions through, and which is hung on two centres, so as to form a shelf when let down; it is fitted with a strong bottom thumb-bolt to secure it in its place. The outer door next the corridor is hung with 4½-inch butt hinges, working on centres, the object being that the door may be opened without noise for inspection; the edge is covered with felt, and shuts into a rebate in the

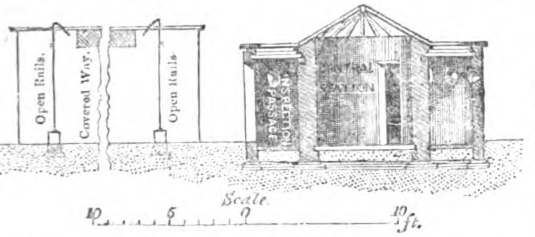




Section at C D.

door frame, flush with the wall. For every cell there are suitable means provided for a constant supply of fresh water, and for necessary relief without entailing unwholesome smells. The exercise of prisoners in the open air, without compromising individual separation, is thus obtained. The airing yards radiate from a central point, round which is placed a dark passage affording an inspection into each yard: the advantage of a dark passage is, that it facilitates close and unobserved inspection. The yards have open railings at both extremities, in order to allow a free circulation of air, and they are so constructed that no two prisoners can see each other. A small roof is attached to the division walls, to afford shelter when necessary, and the position of the yards with reference to the doors in the centre of the prison wings, gives a ready means of access from the cells.

The chapel is fitted up with separate stalls or sittings; the sides of each stall, and the doors, which form the continuation of those sides, and shut up the general passage to each row, radiate upon the pulpit so that each prisoner can see, and be seen by, the chaplain. The back of each row of seats is made of such a height as to intercept the communication between the rows, when the prisoners are standing up, and yet not so high as to conceal them from the observation of the prison officers when sitting down. A double passage is made down the centre of the chapel, opening into and communicating with the gallery surrounding the central hall, and thus affording two points of access to it. A staircase leads from the gallery to a door on a convenient level for entering near the upper row of seats, from whence a succession of steps arranged in pairs communicate downwards with each row in front. The ceiling of the chapel is coved, and ventilators are introduced into it; the roof and the bearers supporting the seats being made of iron. For the ventilation and warming of the prison rooms or cells, an apparatus is placed in the centre of the basement story of each wing, the object of which is to secure a more complete ventilation than could be obtained if the system had been extended from either extremity. The apparatus consists of a proportion of large tubes or pipes for hot water; and in connection with it there is a large cold-air flue communicating with a shaft out of doors, which serves for two wings. The fresh air introduced through the flue is brought in contact with and passes through the tubes of the apparatus, and may therefore be warmed or left at its natural temperature, as may be desirable. The air thus brought from without then passes to the right and left along the flue which runs horizontally under the floor of the corridor, from whence a communication is established by lateral small flues separately with each cell, both on the lower and upper floors.



The means whereby foul air is extracted from the flues are these: a grating is placed close to the door of each cell, on the side next to the outer wall, and diagonally opposite to where the fresh air is introduced. This grate opens into a flue which passes down the outer wall, and communicates with a main foul-air flue placed under the floor of the basement. These main foul-air flues terminate in a chimney-shaft rising above the top of the building. With a view to obstruct the transmission of sound, and prevent that communication which might be attempted by means of the flues, the main foul-air flues are divided into three compartments, one for each range of cells. By means of the system of flues which has been described, a communication is established—first, from the outer air, through the warming apparatus, to the top of each cell; and then from the floor of each cell back again through the extracting or foul-air flues or chimney into the outer air. In order to regulate the quantity of air admitted into each cell, which with apertures of equal size would differ in proportion to the distance from the apparatus, a valve or damper may be placed in the extracting flues, close to the outer door of each cell in the corridor, so constructed as not to close it up entirely, but to leave sufficient range to operate upon the circulation; the damper being at the command of the superintending officer, he is enabled to regulate the quantity according to circumstances. By the application of this system of ventilation it has been found that a circulation of air of from six to eight cubic feet per minute may be kept up through all the cells, at all times of the year, and under all possible circumstances, when the doors and windows of each are perfectly closed. (*Fourth Report of the Inspectors of Prisons.*)

Employments of Prisoners under the Separate System.—In reference to the occupations which will be pursued by prisoners in *separate* confinement in this country, there appears to exist some uncertainty. At Millbank Penitentiary the males are employed in weaving, shoemaking, tailoring, bed-making, and junk-picking; the females in needle-work. In the report of MM. de Metz and Blouet (Paris, July 5, 1837) the following list of trades which may be pursued in prisons on the *separate* system is introduced:—manufactures of polished steel, clasps, hooks, scales, whalebone, jewellery in copper, bonnets, boots and shoes, purses, buttons, bronzes, brushes, picture-frames, cages, canes, pasteboards, baskets, girdles, chains, woollen shawls, footstools, shoes, chimney-pieces, carving, corslets stays, spun and twisted cotton, cutlery, pencils, glasses, breeches, thimbles, ebony-work, fans, tin-work, fringes, scabbards, lace, gloves, wood-engravings for types, laces, lamps, spectacles and eye-glasses, mother-of-pearl ornaments, tea and coffee services, umbrellas, combs, pearls, rackets, paper-rulers, cloth and paper bags, sandals, bellows, mouse-traps, snuff-boxes, and aprons.

Expense of the Separate System.—Any estimate of the expense per prisoner of the *separate* system must, until that system has been for some time in operation, be liable to dispute. At Millbank Penitentiary (which is allowed to be an imperfect criterion) the net annual expense of each prisoner, deducting his earnings, is said to be 24*l.* 6*s.* 6*d.* (Lord John Russell's *Note on Transportation and Secondary Punishments.*) It is urged by the advocates of the system that the sentence of imprisonment in a *separate* prison need be only a half or two-thirds the duration of a sentence to any other prison for it to be as severe and as much dreaded, and that the difference of expense will be thus made up.

State of Prisons and Prison Discipline generally.—In the preceding accounts we have treated of different modes of prison management, and we have stated what are the rules laid down by the law for the government of prisons: but of the prisons of the kingdom, there are a great number which can scarcely be said to come under any description whatever; and the actual management in others, owing to a variety of causes, must not be considered to come up to the rules. The improvement in prison discipline has little more than commenced; and even in the metropolis vices which have been long admitted as such continue in undiminished force. The description of the great gaol of Newgate, given by the Inspectors of Prisons in their Report for 1837, equally applies in the year 1842:—'The prisoners are associated in smaller numbers than formerly, but they are thrown into closer contact, and companionship is more directly facilitated; their mutual acquaintance is more perfect; their knowledge of each other's habits, tempers, and capacities is more readily acquired, more firmly established, and more mischievously brought to bear against the interests of society and their own well-being and reformation. What (say the inspectors) but mischief, inevitable and manifold, can be expected from locking up from morning to night, without intermission and change, in utter idleness (in numbers varying from three to fifteen, or even more), the most abandoned characters, adepts in crime, compelled associates with the uninitiated or trivial offender?' To the Giltspur Street prison language of even more decisive condemnation is applied and continues to apply. Great differences subsist in the dietary of the prisons, in its quality and amount, and the health of those confined suffers accordingly. The prevalent prison disease is *petechia*, or scurvy, which in some cases is attended by prolonged weakness, and in others is so virulent that the patient never recovers. In some prisons the ventilation is exceedingly bad and thereby sickness is generated; while in others colds and consumption originate in the exposure of the prisoners on coming off the tread-wheel in a state of feverish heat. The labour imposed is of every degree of severity, in some instances being too light, and in others excessive. Association in its worst forms has not ceased; little provision is made for the moral amendment of the criminals in many places; and to sum up, there is a general want of uniformity in the discipline, and in the moral and physical treatment of the prisoners, productive of the worst results. The appointment of inspectors of prisons, and the annual publication of detailed reports from these officers, may have contributed to check the growth of some vices and to remove others; but the influence of the inspectors is confined to what may chance to result from their representations: they have no actual authority; and how little, or how slowly, the labours of such officers are attended by practical results may be seen in the case of Ireland, by connecting the state of the prisons there (see below) with the fact that for twenty-five years there have been inspectors of prisons in that country, by whom reports have been annually addressed to the government, which have been published by order of parliament. The circumstance we have stated is not designed to, nor does it, prove the inutility of the appointment in question, but it tends to show that further means are needed to render the prisons of this country what they ought to be.

Other Modes of Punishment.—Criminals are sometimes punished by fine, and sometimes by whipping. Fine is imposed for criminal offences only in peculiar cases—where, for instance, the offender is a wealthy person. Whipping is seldom used excepting in the case of juvenile offenders, or as a disciplinary punishment in the hulks or in prison. By a recent statute (5 and 6 Vic., cap. 51), its public infliction is allowed in respect to any person found guilty of any act intended to alarm or injure the royal person. Notwithstanding the act in question, the principle of corporal punishments is in England, as everywhere else, becoming daily more unpopular, and its practice going into disuse. But by the framers of this act, the end contemplated was to attach the most ignominious penalty to the commission of an offence for which there seemed in successive cases to have been no other or more powerful motive than the desire for notoriety. Another mode of punishment, but one which has also nearly passed into desuetude, is that of the stocks.

Prisoners before Trial.—Prisoners committed for trial or for examination are permitted to wear their own clothing in prison, provided it be sufficient; they are not compelled to work or labour; but at their own request or with their own consent may be supplied with any work not severe, or they may, at their own expense, procure any employment, materials, and tools which the governor may deem safe and proper. Provided no bill has been found against a prisoner, or that upon his trial he has been acquitted, he is allowed such a proportion of the amount of his earnings as the visiting justices deem fit and reasonable. But nothing in the above rule interferes to prevent the governor of the prison from requiring prisoners of this class to make their own bed, and clean the cells, wards, yards, and passages of the division of the prison to which they belong. An untried prisoner may maintain himself, and receive at stated hours a reasonable quantity of cooked provisions, and malt liquor, not exceeding one pint in twenty-four hours; and any linen, bedding, clothing, or other necessaries (subject to a strict search and under such regulations as are deemed expedient to prevent extravagance and luxury); and such articles so procured may be paid for out of the monies belonging to such prisoner in the hands of the governor. No part of such food, malt-liquor, or other articles is allowed to be given, sold to, or exchanged with any other prisoner; and any prisoner transgressing this rule is prohibited from procuring any food other than the prison allowance, or other articles, for such a period as a visiting justice may direct. Prisoners of this class are permitted to see their friends on any week-day without any order, within specified hours; and their legal adviser at any reasonable hour. Letters to and from them are subject to the inspection of the governor. They are liable, in case of their being riotous, or disorderly, or being guilty of a breach of the regulations, to be confined in separate cells, and be allowed no other food from the county than bread and water. (See *Regulations for Prisons in England and Wales*, issued by the Secretary of State, 1841.)

The application of the separate system to untried prisoners remains a subject of controversy. On the one hand, it is contended that any severity not absolutely required in order to secure the custody of an individual charged with offence is unjust; and that the isolation of such an individual is an unnecessary infliction. On the other, it is argued that a separate cell, if it be to some prisoners before trial more obnoxious than association, is not so to others; and that if it be in a particular degree at variance with strict justice to impose on individuals of this class any penalty not necessary for the protection of society, it is likewise at variance with justice and the interests of society to expose them to what is deemed to be an inevitable consequence of prison association, contamination. There is probably no solution of this question which is not open to some objection on principle, and its best solution in practice, we think, is frequency of trial. The importance of a good method of procedure in respect to the unconvicted is illustrated by the following statistics:—

	Males.	Females.
The total number of prisoners before trial in the prisons of England and Wales in the course of the year ending Michaelmas, 1837, amounted to	26,344	[illegible]
Of this number there were committed for re-examination, but afterwards discharged, there not being even a *prima facie* case against them	4,396	[illegible]
Acquitted	3,284	[illegible]
No bills found	1,162	[illegible]
Not prosecuted	869	[illegible]
Making a total of . . .	9,713	[illegible]

with reference to whom the charges brought against them were not substantiated.

The time during which this number of prisoners was confined, before trial, was as follows:—

	Males.	Females.
Under fourteen days	12,230	3,955
Fourteen days and under one month . .	5,181	1,367
One month and under two months . .	4,505	1,082
Two months and under three months . .	2,431	471
Three months and under six months . .	719	166
Six months and under one year . .	102	13

(*Inspectors' Report*, 1838.)

Besides what the above returns show in condemnation of the existing modes of procedure in reference to the unconvicted, an instance is quoted by the Inspectors of Prisons, of a prison where the punishments for breach of regulations incurred by the untried were greater in amount than those incurred by the convicted. In this prison there were 90 untried prisoners, who were visited with 224 punishments; while 236 convicted prisoners were visited with 574.

Disposal of Criminals after their Discharge.—The disposal of criminals after the expiration of the period of their imprisonment is in England one of the most difficult questions connected with punishments, and it is one for the settlement of which no measures have yet been adopted or devised. Until this deficiency is supplied, under any system of secondary punishment whatever, the immense amount of recommitments which take place in this country may be expected to continue. The amount of recommitments is an evidence not merely of the inefficiency of particular modes of punishment, but probably, more generally, of the difficulty of finding employment in this country. Mr. Bentham suggested several means whereby this object might be met: employment in the army or navy; the encouragement of voluntary emigration to the colonies; the requiring of security for good behaviour, with liberty to the surety to contract for the prisoner's labour; or a subsidiary establishment for the reception of the prisoners under a modified kind of imprisonment. Of these methods it is not improbable that the encouragement of voluntary emigration will be resolved upon. It is a question whether the emigration should not be compulsory instead of voluntary. But to this it has been objected, that making emigration thus as it were a punishment or part of a punishment, would tend to render it, by association of ideas, a mark of disgrace, whereas it is desirable that industry should be encouraged to find channels for itself in the colonies.

Punishment of Juvenile Offenders.—Until recently there was no further distinction observed in the discipline of juvenile offenders than by their separate classification from the adults in the hulks, in prisons, &c., where they were put to the same or nearly the same routine of duties as the adults; but with the establishment of the Parkhurst Reformatory, in the Isle of Wight, the commencement of systematic improvement in this respect has been made. Of this prison, as it is to be a model for similar prisons to be established in different parts of England, we shall introduce some account. It occupies a square area of about four acres in extent, the enclosure being 410 feet from north to south, and 420 from east to west. It is encompassed by a boundary-wall, which at its lowest part is 15 feet high. The entrance to the prison is at the centre of one of the sides, by an arched gateway of stone. To the left of the entrance is the gatekeeper's dwelling; to the right a corresponding building, containing an examining-room, with two small separate cells opening into it: beyond are a cleansing-room and bath, attached to which is a fumigatory for purifying the prisoner's clothes. Fronting the entrance is an esplanade of about 250 feet by 200 feet, on the opposite side of which, in the centre, is the governor's house, including offices and store-room. To the right and left of the centre are buildings containing the sleeping-cells of the prisoners. The buildings are two-storied, and have each 36 separate cells, which are 10½ feet by 6 feet, with access by external doors; a gallery of slate, which rests on iron supports, giving the means of communication to the doors on the upper floor. Connected with these two buildings, by a turnkey's room, are two other buildings, standing east and west, similar in all respects to those before described. Still farther to the east, and connected by the external galleries to the other buildings, are two detached buildings, three stories high, containing thirty separate cells, the access to which is by an internal central passage. On the upper story of each of these buildings is an infirmary, which is warmed by an open fire-place; the ceiling coved up to a central aperture for ventilation, communicating through the roof with the external air by a turn-cap. The cells are ventilated by several small openings in the ceiling of each, communicating with a vertical shaft, one to each cell, worked in the brick division-walls, communicating at top with the vacant space of the roof, over the ceilings of the upper floor of cells: from hence the heated and foul air escapes by louvre-turrets, two to each building. The cell doors to the four buildings, which have external access, are of slate, one inch thick, lined in the inside with wood also one inch thick; these doors are shut into wrought-iron rebated door-frames. The cell doors to the two buildings which have an internal passage are of wood in two thicknesses, braced and secured with hoop-iron worked in between the two thicknesses; these doors shut into Portland-stone rebated jambs. Beyond the governor's house to the west is a range of building one story high, containing at the east end a scullery and kitchen for the prison use, the latter fitted up with a steam apparatus for boiling separately soup, gruel, meat, vegetables, &c.: northward of the kitchen are two store-rooms. In the centre of this range of buildings, and equi-distant from all the extremities of the prison buildings, is the chapel, fitted up with moveable benches. Parallel with this range of building, and to the west, is the junior ward for the reception of 120 children under 12 years of age. On the ground-floor, in the centre, are the entrance lobby and school-master's room. To the right is the school-room, 30 feet by 20 feet, and to the left the eating-room of the same size: beyond these two rooms, at each end, is a dormitory 30 feet by 20 feet. The ventilation of these rooms is secured in the way described before in reference to the other prison buildings. The upper floor of the whole of this junior ward is appropriated as dormitories for the children, and at each wing is a turnkey's room. Farther to the west, and parallel to the junior ward, there is a rope-walk 300 feet long. On the north side of the area, 15 feet within the line of the boundary-wall, is a laundry; adjoining which to the east and west are ranges of workshops two stories high, fitted up for the employment of the prisoners in the various trades in which they are instructed. Detached from these, farther to the east, is a building for the employment of the boys, consisting of a bakehouse and smith's shop. On the opposite side of the precinct, and adjoining the south boundary-wall, is a large hall 100 feet long by 40 feet wide and 21 feet high, lighted and ventilated by seven large windows, and having three separate entrances (the hall being capable of temporary separation into three divisions), which is used for in-door recreation, and for any purpose in which it is required that the children should be collected. In the centre of the esplanade, sunk below the surface of the ground, is an hydraulic engine (which may be worked by eight boys) for lifting water from the well immediately beneath, and forcing water up to the slate cisterns at the infirmary, the kitchen, the governor's house, and the washing-places. (*Third Report of the Inspectors of Prisons.*)

The objects sought to be attained at the Parkhurst prison are, the penal correction of boys with a view to deter juvenile offenders generally from the commission of crime, and their moral reformation. In carrying the first of these objects into effect, it is professed that the utmost care is taken to avoid any species of discipline which is inconsistent with the habits and character of youth, or calculated in any degree to harden and degrade. The second object is sought by a judicious course of moral, religious, and industrial training. In the general treatment of the boys, every comfort and indulgence not necessary to preserve the health of the mind and body is excluded. On the 1st January, 1841, 247 juvenile offenders were confined in this prison, which number was increased during the year to 302. The employments in which the boys are trained are those of tailoring, shoemaking, gardening, and agriculture; besides which they receive a general education fitted to their future destination in life, including reading, writing, and the common rules of arithmetic. In 1841 the total expense of the prison, exclusive of those for repairs, alterations, or additions to the buildings, was 5814*l.* 11*s.* 1¾*d.*, and the total cash receipts for contract and other work, and for the produce of the prison farm, was 587*l.* 6*s.* 0½*d.* The average expense per prisoner is under 20*l.* per annum. The disposal of the boys at Parkhurst on release appears to be a question of some difficulty. Of those liberated since its establishment some have been apprenticed to the trades in which they were educated there; others have been sent to the Refuge for the Destitute, and the Philanthropic Institution, and a considerable number have recently been sent to New Zealand. The adoption of some scheme for their emigration is understood to be in contemplation. (*Reports relating to Parkhurst Prison.*)

The establishment of a prison for juvenile female criminals, on the principle of Parkhurst prison, has been resolved upon by the legislature.

Institutions auxiliary to those for Punishment. (*Houses of Reform.*)—There are several institutions auxiliary to the penal institutions of the country, without taking some notice of which the operation of these last cannot be so fully appreciated. The institutions referred to are either wholly supported by voluntary contributions, or partly by voluntary contributions and annual parliamentary grants, and their objects are to receive convict youths after they have endured the sentence of the law, as voluntary inmates, and to educate them in suitable branches of knowledge, and in useful trades; or to receive the destitute offspring of adult convicts who have been executed or transported, or are imprisoned for a lengthened period, and to give them the advantages mentioned. In the metropolis, where the models of these institutions are to be found, there are two which may be referred to in illustration. These are the Refuge for the Destitute, and the Philanthropic Society's Institution.

The Refuge for the Destitute was founded in 1805, and incorporated by Act of Parliament in 1838. It is a place of refuge for young persons, of both sexes, discharged from penal confinement; or who, having lost their character by dishonest practices, are unable to procure an honest maintenance. The females in the establishment are employed in washing and in needlework, for which the institution contracts with the public, and in household work. The males are employed in shoemaking, tailoring, and preparing fire-wood for sale. As an encouragement to good conduct, a portion of their earnings is reserved for those who have been discharged. The objects of the institution having acquired a competent knowledge of religious and moral duty, and been trained to such habits of industry as may render them useful members of society, a reconciliation to their friends or relations, if persons of character, is attempted: if they are otherwise, the youths are placed out in suitable situations, or bound apprentices to respectable tradesmen, and rewards are conferred on those who are observed to persevere in good conduct. During the years in which the Refuge has been open nearly 6000 outcasts have received maintenance and instruction within its walls, many of whom are now respectable members of society, and some subscribers to the institution to which they owed their rescue from destruction. (*The Society's Reports.*)

The Philanthropic Society embraces in its scheme, besides juvenile criminals, the destitute offspring of criminals. The education given at the Society's institution, in addition to the details at the Refuge, includes the trades of printing, book-binding, rope and twine making. To those young men who, after quitting the institution, bring satisfactory testimonials from the masters by whom they have been employed, of honesty, sobriety, and steady habits, rewards varying in amount are given at the end of one and two years respectively. The inquiries of the committee of this institution were successful in obtaining information of the fortunes of about 180 of the boys admitted within 25 years previously to 1842. Of these 180 nearly 150 were steadily pursuing the various branches of industry they had been taught and apprenticed to, and mostly with a fair average success. Of the remaining thirty who had left their original business for the army, the sea-service, or other occupations, only six had been found guilty of offences against the laws. This institution is entirely dependent upon voluntary contributions. (*An Account of the Philanthropic Society*, 1842, printed at the Institution.)

Prisons of Scotland and Ireland.—The prisons of Scotland were in a state of gross mismanagement when, in 1826, a committee of the House of Commons was appointed to inquire into the subject. The recommendations of that committee, the appointment of inspectors, and the passing of an act of parliament (2 & 3 Vic., c. 42), by which the burden of maintaining prisons is removed from the royal burghs, and provided for by a general rate upon property, and their management is devolved upon county boards and upon a general board sitting in Edinburgh, have led to some improvements, and paved the way for still greater. Where system can be said to have been attempted in Scotland, it has been one of those which we have noticed in connexion with England. The separate system has been for several years in force at Glasgow in respect to prisoners, the duration of whose sentence is six months or under, and, according to the reports of the inspectors of Scotch prisons, with generally good effects, although the construction of the prison in which it is carried out is not completely favourable. The difficulty of procuring employment on release from prison has however been so great, that lately criminals in confinement at the Glasgow penitentiary, when in prospect of their liberation, have been found to threaten the commission of crimes by which they might again be sent there. Another separate prison has been established at Perth, and the extension of the system is contemplated by the board of direction in connexion with Scotch prisons, provision for the purpose having been made already by parliament.

The gaols of Ireland are regulated by an act of parliament (7 Geo. IV., c. 74) passed in 1826, by which annual reports of the state of the several prisons are required from inspectors of prisons who had been appointed some years previously. From the reports of the inspectors a lamentable picture is to be drawn of the management of the prisons so recently as the last year (1841). Industry appears to have been only partially introduced; classification, where it is attempted, is of the most imperfect description; and lunatics are frequently committed to prison simply as being dangerous to society, of which practice the results are, 'that each prison in the kingdom has charge of from five to ten lunatics, and even more, to the great injury of the internal discipline and peace of the establishment, as well as to the poor individuals, as there is no proper accommodation for them, or means of treating the disease with a view to cure.' (*Report of the Inspectors of Prisons for Ireland*, 1842, p. 9.) The inspectors specify prisons in which the accommodations are sufficient for little more than a half of the average number in custody (p. 17), and where the cells intended for one are generally occupied by three prisoners; where a dungeon having scarcely any means of ventilation, without light or heat, contained in the hours of night an unhappy maniac (p. 18), and where the prisoners are mentioned as 'poor creatures, many of them half naked, lieing about in tatters' (p. 21). All these disgraceful incidents occur in the capital of Ireland. In parts less exposed to notice, the vices of the prisons are, if possible, worse. Modifications on the principle of separation are contemplated in respect to such of the Irish prisons as are capable of receiving them, with a view to the adoption of the separate system, should it be found to work well. (*Report*, p. 5.) The extreme poverty to which many of the Irish are reduced, and the consequent deprivation of comforts which they sustain, render it difficult to devise a system of treatment which shall not either operate as a temptation to crime or be liable to the charge of undue severity.

Prisons in the British Dependencies.—The attention of the general government of India was drawn some years since to the state of the prisons and convict discipline in the several provinces of that country, and a very able and elaborate report by a committee appointed to inquire into these subjects was printed in 1838. From this Report it appears that the manner in which criminal prisoners have been generally employed has been in working upon the public roads in fetters, under the superintendence of native soldiers. Female prisoners, where employed at all, have been so in gaol, excepting infirm prisoners, who have gone daily to some distant place to pound bricks. In some cases male prisoners have been employed in weaving cloth: in the manufacture of shatrangees, or cotton carpets; and on the tread-wheel, when confined to prison; but in others they have been kept completely idle. The classification observed in different gaols has been as diverse as the employments, and, in the words of the Report, 'so imperfect as hardly to deserve the name.' (Article 50.) It has been customary to supply prisoners with a money allowance with which they have been permitted to purchase their own food from shopkeepers, to whom access to the prisoners has been allowed; and it appears that the prisoners in such cases have fared better than the agricultural labourers. The means of ascertaining the recommitments have been very imperfect, which renders the average of the following per centages rather below than above the truth: in the lower provinces of the presidency of Bengal, about nine and a half; in the north-western provinces, about ten and a third; in the Bombay territories about six; in the whole of India, about eight and three-quarters. These proportions are not large, but, besides the imperfect means of ascertaining them, it is to be observed that they refer to the numbers who have been before sentenced to the same gaol only.

From various causes the difficulty of establishing a system of punishments in India which shall be free from radical objections is very great. 'For the mere locality of the prison, that which is healthy in one season may become a pest-house by a blast of fever or of cholera in another. For its form, the close yard, which is adapted for classification and is not unwholesome in England, would be a sink of malaria in India. For food, for labour, and for consort, there are habits, and an inveteracy of prejudice and of feeling, bearing upon health, and almost upon life, opposing difficulties to the just management of prisons, such as are not elsewhere to be encountered; and superadded to all this is the absence of fitting instruments for control and management.' (*Resolution recorded by the Government of India on the 8th of October*, 1838, *after taking into consideration the Report of the Committee on Prison Discipline*, Calcutta, 1838.) In India also, manual labour is so cheap, and machinery so expensive, that it is improbable that the produce of prison industry will ever be profitable. The establishment of central penitentiaries for the reception of two thousand prisoners each, and connected with the several gaols of the districts, as recommended by the committee, has been so far approved by the Council of India, that a central penitentiary, to be conducted on improved principles, is now in progress of erection in the Bengal presidency. At this penitentiary labour-wards will be fitted up for every description of labour to which it may be determined to give a trial. Three hundred cells will be prepared for prisoners to be confined within them by day and night, ten of which to be dark or capable of being darkened, and the rest to have small yards attached to each. Sleeping-cells are to be constructed for each of the remaining prisoners, and a court for every fifty, into which not more than half that number will be allowed access at one time. A system of rations will be substituted for money allowances on account of food. Tread-wheels are to be provided; strict silence is to be enforced at all times. For breach of prison rules, solitude in darkness and privation of food are to be the punishments; and if experience prove it to be indispensable, whipping is to be resorted to. Several measures of reform are likewise to be introduced in the district gaols connected with the central penitentiary, or should experience render the extension of the plan advisable, penitentiaries. Experience, however, is to determine every detail which should be introduced or retained; and with a view to bring the results of experiments under the notice of the general government, inspectors are to be appointed, whose duty it will be to make periodical reports. (*Report of the Committee on Prison Discipline to the Governor-General of India in Council*, January 8, 1838, Calcutta.)

An inquiry was instituted in 1837-8, through Captain Pringle, into the state of the prisons of the British West Indies, which appears at that time to have been very defective. Classification seems only to have been practised in the gaols to the extent of locking up the sexes at night in different rooms, excepting at Spanish Town and Kingston, where debtors had a separate yard: in the latter the females had also a separate yard; but the general practice was, that all classes, convicted and untried, males, females, and debtors, had almost unrestricted intercourse with each other. Personal cleanliness was not enforced, and for the most part the prisoners were filthy in their persons and clothes. Soap was not given to them. No prison-dress was allowed, except where those belonging to the prisoners were ragged in the extreme. Money was allowed instead of food; the apprentice-convicts (originally slaves) were still heavily fettered with irons on the leg, weighing from nine to fifteen pounds: to prevent escape chains were used; no work was exacted from the prisoners, and few were employed. Prisoners in the houses of correction were brought out every morning to work—men and women, men chained in couples, women the same—in gangs, on the roads, quarrying, carrying, and breaking stones. The supervisors chained such together as they thought proper, commonly two of unequal strength, to allow less chance of escape: old men were thus found chained to boys, and girls to old women. On many of the plantations where slavery existed, there were cells and dungeons provided with bilboes or chains, and shackles: these places, though very unfit for the purpose, were frequently used, at the time of Captain Pringle's inquiries, as prisons. (*Report of Captain J. W. Pringle on Prisons in the West Indies*, July, 1838.) Since 1838 some improvements have been introduced into the penal institutions of the West Indies. An act was passed in that year (1 and 2 Victoria, cap. 67), 'An Act for the better Government of Prisons in the West Indies,' by which rules for the government of the prisons of each colony are ordered to be prepared by the governor and council—the governor is authorised from time to time to appoint inspectors—periodical reports are required respecting each prison—imprisonment is prohibited from taking place in prisons declared to be unfit, and some minor reforms are provided for.

The government of Lower Canada, in 1835, appointed commissioners to visit the United States penitentiaries, and to report upon them, with a view to the introduction of improvements into Canada. These commissioners reported that, according to the Auburn practice, a higher degree of profit was to be obtained from the labour of the convict; according to the Philadelphia practice, a more subdued tone of mind in the convict, and apparently a greater reform in his disposition and habits, but less profit from his labour. Weighing these respective advantages, they recommended the adoption of the separate system; but we are not aware that their recommendation has been yet executed. (*Report* of the Hon. D. Mondelet and J. Neilson, Esquires, Quebec, 1835.)

Capital Punishments.—The ordinary mode of inflicting the punishment of death in England is hanging by rope. Murderers, after execution, were formerly either given to be dissected or hung in chains; but by the 4 and 5 William IV., cap. 26, those practices were abolished, as also the hanging in the first instance of murderers by chain instead of by rope, and the bodies of such criminals are, by the same act, ordered to be buried within the precincts of the prison in which they were confined after conviction. When Blackstone wrote his 'Commentaries' there were one hundred and sixty offences to which the penalty of death was attached. At the present time that punishment is confined to a few of the worst crimes only. It is not irrelevant to introduce some notice of the effects which have been observed in connection with a change so remarkable, and a change which has not been aided in its favourable tendencies by sound institutions for secondary punishment, but rather counteracted by radically inefficient and vicious ones. In the year 1821 there were 114 executions in England and Wales; in 1828 the number was reduced to 59; in 1836 to 17; and in 1838 it was only 6. That this change has been effected without diminishing the security of person and property there is this evidence, that there have been a smaller number of highway robberies in the last 7 years, with 5 executions, than in the preceding 7 years, with 58 executions; that there have been a less number of acts of burglary and house-breaking in the last 7 years, with only 2 executions, than in the preceding 7 years, when 57 persons suffered death for those crimes; that there has been less horse-stealing in the last 7 years, without any executions, than in the preceding 7 years, during which for that offence 22 were executed. There have been a less number of commitments for murder in the last 5 years when the executions for that crime were 40 (or 8 annually), than in the five years preceding, when the executions were 66 (or 13 annually). The following tables place in a clear light the statistics of crime in connection with the mitigations of the penal code:—

London and Middlesex.—For crimes capital in 1828. From 'Parliamentary Return,' No. 165, printed 1837.

Three Years.	Executed.	Committed.
1828-29-30 . .	52 . .	960
1831-32-33 . .	12 . .	896
1834-35-36 . .	none . .	823

The foregoing shows a decrease of the crimes that were capital in the first period. During the same three periods (in London and Middlesex) the committals for minor offences increased, being respectively 9,513, 10,049, and 10,006.

England and Wales.—From 'Parliamentary Return, No. 547, printed 1839.

Five Years.	Executed.	Committed.
1829-30-31-32-33 . .	259 . .	11,982
1834-35-36-37-38 . .	99 . .	11,332

This return also shows a decrease of the crimes that were capital in the first period. During the same time the committals for minor offences (*i. e.* offences not capital in the year 1828), increased; being 85,348 in the first period, and 99,540 in the second period.

It is thus shown that while crime in general was increasing, there was a diminution in the number of those offences for which the punishment of death was partially discontinued or altogether abolished, and another penalty substituted.

That juries were prevented from convicting where the offender's life was in jeopardy was one of the objections to the punishment of death, which was urged in support of its abolition. The truth of that objection has been substantiated by subsequent experience, as the following returns (Parliamentary Papers, No. 87, 1840), show:—

England and Wales.	Three Years ending Dec. 1836.	Three Years ending Dec. 1837.
Executions	85	25
Commitments for offences which were capital in 1824	3,104	2,989
Convictions for the same .	1,536	1,788
Centesimal proportion of convictions to commitments .	40	59

Murder.—England and Wales.—From 'Parliamentary Return,' No. 48, printed September, 1841.

Periods.	5 Years ending 1825.	5 Years ending 1830.	5 Years ending 1835.	5 Years ending 1840.
Committed	383	317	339	291
Convicted	83	74	81	87
Executed	76	65	66	40
Centesimal proportions of executions to convictions . .	86	87	81	45
Centesimal proportion of convictions to committals . .	22	23	23	29

Here it is shown that in the last period, when executions became less frequent, the crime of murder became less frequent; and that juries convicted one-fourth more criminals, namely the centesimal proportion of 29 instead of 23.

In 1840 a 'Parliamentary Return,' No. 87, was printed showing, for five consecutive years, the number of persons sentenced to death for murder, 'whose punishment was commuted; specifying the counties in which their crimes occurred, and stating the number of commitments for murder in the same counties, during the same year, and in the following year.' This return exhibits a striking fact, namely, that in not a single instance was there an increase of the crime, although those commutations of the sentence of death extended over fifteen counties.

In the present year, 1842, another document, No. 36, has been printed by order of parliament. It exhibits the number of executions for all crimes in London and Middlesex during 21 years, divided into seven triennial periods; together with the committals on charges of murder. In one of those periods, namely, the three years 1834, 1835, 1836, no execution whatever took place; and it is shown upon official authority, that that was the only period in which there were no convictions for the crime of murder. (See a paper issued by the Anti-Capital Punishment Society, 1842.)

The punishment of death is in England always publicly inflicted, and an execution leads to crime by bringing the hardened and the daring together. No picture that has been drawn of the scenes which commonly take place around the scaffold can be too highly coloured for a representation of what may be seen on the morning of an execution in the neighbourhood of Newgate. It is difficult to show what good object is effected by the spectacle of an execution; it is equally impossible to calculate the demoralising consequences which spring from it. This has given birth to an opinion in which well-meaning persons sympathize, in favour of the private execution of the sentence of death. But the prejudices of Englishmen are opposed to such a change, and a motion which was introduced in the House of Commons to that effect, about two years since, was almost unanimously negatived. Opinion is gaining ground in favour of the entire abolition of death punishment; but more efficient provision for secondary punishment, it is alleged by many who are opposed to capital punishments, is needed in order to render such a step beneficial.

Progress of Penal Reform in Foreign Countries.—The subject of punishments engaged general attention at an earlier period in America than in this country; and from the results of experiments which were tried there some valuable hints for the improvement of penal discipline have been derived by European states. In 1776 a society was formed in Philadelphia, the objects of which were to obtain a mitigation of the criminal code and a reform in prison management. To the recommendations of this society the legislature of Pennsylvania, in the year 1786, yielded to the extent of abolishing the punishment of death in all except two or three cases. This measure was however nearly counterbalanced by the immediate introduction by law of hard labour in a public and disgraceful manner enforced by corporal punishment. From this measure there resulted a complete demoralization of the convicts and the most pernicious influence upon the free community, frightfully increasing instead of diminishing crime, which obliged the legislature to abolish it within four years from its adoption. Solitary confinement with laborious employment was then introduced. It appears however that the construction of the prison in which this system was first tried was defective, and that the system could not thus be fairly carried out; and the experiment was a failure. Another prison on the same system was afterwards, in 1818, erected at Pittsburg; but owing again to errors in the construction of the building, the expectations of the founders were defeated. The state of Maine next tried the experiment, but with no better success than in the previous instances. Once more it was tried at Auburn in New York, and there several of the prisoners became insane, the health of some was destroyed, and of others seriously impaired, which led to its abandonment and the introduction of the *silent* system at Auburn. The advocates of *separate* imprisonment however still maintained the advantages of that over every other system, and contended that a fair trial had not been given to it in any of the instances we have mentioned. The result of their persevering advocacy was the establishment of the Eastern Penitentiary of Philadelphia in 1829. Since that period the operation of *separate* confinement in America, besides being subjected to strict criticism, has engaged the attention of the governments of England, France, and Prussia, by whom commissioners have at different times been sent to that country for the purpose of inquiring into and reporting upon its penal institutions. (Mr. Crawford's *Report*, and the *Reports*, in French, of MM. de Beaumont and Tocqueville, MM. de Metz and Blouet, and that translated into French from the German, of Dr. Julius. The testimony, more or less decided, of all these authorities is in favour of the separate system of the Philadelphia prison and against the silent system of Auburn. Health, which it was apprehended and urged could not be maintained consistently with the enforcement of complete separation, has not to the degree supposed apparently suffered from it. The average mortality during the first seven years of its establishment did not exceed three per cent., and of 312 prisoners who left in that time, 78 were in better health, 166 in equal health, 17 weaker not worse, 13 in worse health, 4 much worse, 34 dead, including one suicide. (Mr. Crawford's *Report*.) In 1838 the cases of madness or idiotcy were 14 among 387 prisoners; in 1839 they amounted to 26 among 425. M. de Tocqueville, from whose statement we quote these proportions, gives it to be understood that previous to 1838 the statistics of madness in the Philadelphia prison are not to be relied on: the same authority says, that *separate* confinement has in that penitentiary particularly austere features, the consequence, he thinks, of its having been formed rather with a religious than a political aim. A modification of this austerity would diminish or altogether prevent madness or idiotcy, he conceives. (Pp. 43-4, *Rapport fait au nom de la Commission chargée d'examiner le projet de loi tendant à introduire une Réforme dans le Régime Général des Prisons, par M. Al. de Tocqueville, Chambre des Députés, Session* 1842.)

The social and economical circumstances of the United States are favourable to the system of *separate* confinement in a financial point of view, there being a demand for the articles of penitentiary manufacture; and they are further favourable in a political view by affording the prospect of employment in the trades in which they are educated in prison to the convicts when liberated. Since the erection of the Philadelphia Penitentiary, prisons on the principle of separation in cells have been opened at Pittsburg, and in the states of New Jersey, Rhode Island, Missouri, and others are in process of erection.

In the prisons on the *silent* system in the United States silence is enforced by the instant use of the lash, sometimes to a most barbarous extent.

The reader is referred for further information respecting the prisons of America to the works which have been quoted in this notice.

In France prison management is still behind that in England. The prisons of that kingdom are divided into those for offenders sentenced to hard labour, *bagnes*; for offenders sentenced to terms of imprisonment exceeding one year, *maisons centrales*; and for offenders sentenced for periods less than a year, *maisons départementales*. Distinct establishments are provided by the law for prisoners before trial; *maisons d'arrêt* for persons arrested; *maisons de justice* for those against whom a warrant of caption has issued from the court; *maisons de dépôt* for the temporary custody of persons apprehended. The *bagnes* of France are similar to our hulks, and are established at Toulon, Brest, and Rochefort. Criminals sentenced to ten years hard labour and under are sent to Toulon: those condemned for life, or for upwards of ten years, are sent to Brest and Rochefort. At Toulon the prisoners are divided into three categories, *les inconnus*, *les méritans*, *les indociles*. The first are kept in the *bagnes flottans*, where they pass the night and chief part of the day. They constitute the largest class, being composed of those who have not by good conduct recommended themselves to any mitigation, or by bad conduct become obnoxious to any increase of their punishment. Each *inconnu* is coupled to another by a chain, and the two become inseparable companions. The second division of *forçats*, or prisoners, bears the name of *salle d'épreuve*, and includes such as have by good conduct recommended themselves to a mitigation in their lot. From this class are chosen those to whom petty employments in connection with the establishment are given. They are distinguished by a difference of ress, they receive better food, and are besides freed from hains, wearing an iron ring instead on each leg. The *in- orriles* consist of those who give no signs of amendment, nd from whose association corruption is found to result o the rest. The *forçats* are employed, according to their lass, in carrying large pieces of timber to be used in the onstruction of vessels, in works in straw and pasteboard, ailoring and shoemaking. These two last occupations are iven in particular to prisoners who have attempted to scape, and they are kept chained to their beds while ngaged in them. The detail of the *bagnes* at Brest and ochefort are of the same character as at Toulon. (*De Etat Actuel des Prisons en France considéré dans ses pports avec la Théorie Pénal du Code*, par L. M. Moreau-Christophe, Sous-Préfet, Ancien Inspecteur-Général es Prisons de la Seine, Paris, 1837.) Since M. Christophe rote no change has been made in the system of the *gnes*, and M. de Tocqueville, in a recent report (quoted bove), thus refers to them:—'Il n'y a pas une voix dans pays qui ne réclame contre l'existence des bagnes. 'emprisonnement aux bagnes est une peine dégradante, et i, cependant, est peu redoutée par la plupart des criminels. Elle blesse tous les sentiments et toutes les idées de otre temps en matiere de peine, et, avec les extérieurs de barbarie, elle ne détournee pas des crimes qui amènent la subir.' The number of criminals in the *bagnes* has een gradually diminishing of late years: in 1836 it mounted to 6425, all males.

The *Maisons centrales* receive criminals of both sexes. he surveillance of each *maison centrale* is confided to the refect of the department where it is situated, under the ontrol of the minister of the interior. Under the prefect re responsible officers intrusted with the discipline, the ealth, and religious teaching of the prisoners. The rules f each prison are left to a great extent to be made by the refect; the consequence of which is a want of uniformity n the prisons generally. The prisoners are employed in ifferent descriptions of manual industry, and a part of eir earnings is reserved for their benefit on liberation. he nature of the classification in the *maisons centrales* is ot such as to prevent general corruption; and M. Christophe gives a painful picture of some which he had himelf visited. In 1836 there were 15,870 criminals in the *aisons centrales*.

The *Maisons départementales* appear to remain in a worse ondition even than the *maisons centrales*. They have een left to the administration of local authorities, ignorant r uninterested in the improvements of the art of prison iscipline; and associated together in them are to be met les prevenus et les condamnés, les mendicants, les vagabonds, les aliénés, les hommes, les femmes, les enfans. Point de distinction de crime, ni de peine, de sexe ni l'âge. Tout cela vit ensemble comme une famille attablée au vice. Point de travail qui fasse diversion; l'oisiveté les ronge: ces sont des auges à pourceaux.' (Leon Faucher, *Description du Fort du Hal*, quoted by M. Christophe.)

In the *maisons d'arrêt*, *maisons de justice*, and *maisons de dépôt*, association in its worst forms has hitherto existed.

The attention of the government of France has been lately directed to the state of the penal institutions of that kingdom; and the results are, that a prison on the separate system has been provided by the council-general of the department of the Seine for the untried; and the appointment of a commission of inquiry and advice by the Chamber of Deputies. This commission, in their Report (1842), recommend the doption of the separate system for the convicted as well as unconvicted: but they appear to have considered this system, as enforced at the Philadelphia Penitentiary, to be too austere in character; and it is proposed to modify its features in France. A model prison has been set on foot at Versailles.

In France there are several institutions or societies auxiliary to the prisons, for the benefit of liberated convicts.

One of the first acts of the government of Belgium after the revolution of 1830 was to mitigate the severity of the criminal code, improve the methods of criminal procedure, and reform the prisons. The prisons of Belgium are similarly divided to those of France, into *maisons de dépôt et de passage*, *maisons d'arrêt et de justice*, *prisons pour peines*. M. Christophe represents the greater number of the *maisons de dépôt* as consisting of an agglomeration of many apartments without courts, where the ages and the sexes are often confounded. In the *maisons d'arrêt et de justice* an attempt is made to classify the prisoners according to their moral character, as well as ages and sexes. The *prisons pour peines* fail in effecting any of the purposes for which they were designed. The labour of the prisoners (of various descriptions) is easy; they receive a weekly money allowance, which they are allowed to spend in the purchase of beer, tobacco, &c.; so that the prisons, instead of being dreaded, are esteemed agreeable places of resort. The Belgian government is impressed with a conviction of the necessity which exists of introducing a systematic improvement into the prisons of that kingdom, and the advantages of the separate above any other system are strongly maintained by M. Ducpetiaux, the inspector-general of prisons in Belgium, at whose instance a trial of it is now being made on a limited scale at Ghent. (*Rapport sur les Prisons de l'Angleterre, de l'Ecosse, de la Hollande, de la Belgique, et de la Suisse*, par M. L. Moreau Christophe, Paris, 1839.)

In Holland the prisons are divided similarly to those of France and Belgium, into prisons for the accused, for the convicted, for female, juvenile, and adult offenders. In the prisons for the convicted there are divisions for criminals under punishment for minor and for heinous offences. Association in one form or another is allowed in all the prisons, classification being the only means employed to counteract or control the spread of contamination. The number of the classes is ordinarily three or four in each prison, consisting of those who are badly conducted and the recommitted, the doubtful, and the well behaved. Each class has a yard, a refectory, workshops, and dormitories distinct. The classes are subjected to a *régime* more or less rigid, consisting, among other particulars, in the interdiction of the visits of parents or friends, and of the indulgence of spirituous liquors and tobacco; in depriving them of the most productive employments, thereby diminishing the proportion of profit received by them; the refusal to commute their sentence or alleviate its severity; the prohibition of speech and (a measure, M. Christophe says, but feebly attempted, owing to the deficiency of means) cellular separation. To every prison there is attached a council of regents, which periodically reports to the minister of the interior. The defective state of the prisons of Holland is generally acknowledged in that country, and societies have been instituted there for the purpose of obtaining ameliorations in them, and in the meantime of introducing incidental means of improving the criminals. There are also societies for the patronage of liberated prisoners.

The spirit of improvement in penal law and discipline has been excited in different parts of Germany; and although the tortures and fetters of uncivilized ages are not quite discontinued, they are sparingly used, and are likely soon to give place to mild institutions. The progress towards a good system varies in the different states and kingdoms.

A few years since the prisons of Hungary are described as having been in a worse state even than were those of England in the days of Howard. But the accounts published in 1830, by Böloni Farkas, a Hungarian traveller, of the United States penitentiaries, excited the attention of leading men, and led to the introduction of labour and of improved means of health into the existing prisons.

In 1837 the county Bihar resolved to make a trial of the Auburn system on about eighty prisoners, the number in confinement in the prison of Bihar being six hundred. The same experiment was shortly afterwards adopted in the county Abauj; and two years later, a prison adapted to the complete execution of the system was established in county Komarom. At a more recent period the visit to England and to the Continent of two Hungarians, Szemere and Eötvös, the first of whom became a partisan of the separate, the second of the silent system, originated a controversy, which still continues, on the merits of these systems, in Hungary. Some practical results would have arisen before this from the efforts of these gentlemen in the counties; but the diet of 1839 and 1840 had previously come to a resolution to introduce a uniform prison discipline throughout the whole country, and a delay was to be allowed to collect the information by which the nature of that discipline should be determined. Two commissions are now sitting at Pesth; the one intrusted to draw up a project of a criminal, and the other that of a prison code. The commission on prisons has decided in favour of the separate system, and has submitted a project for the erection of ten penitentiaries, corresponding to which it is proposed to divide the country into ten districts. The coming diet (for 1843) will take the recommendation of the commission into consideration; but it is impossible to predict what its decision may be. The enlightened men of Hungary are mostly in favour of the separate system; but unless that system carry the approval of the people who control the votes of the deputies in the diet it will not be adopted. We are not aware of any improvements being contemplated in respect to the prisons in other parts of the Austrian empire. At present their state is understood to be very bad.

The employment of prisoners on the tread-wheel was introduced into some of the prisons of Prussia a few years since, on the recommendation of Dr. Julius. Classification to a limited extent was adopted about the same time; and, following the progress of improvement in this country, the silent system was next brought into operation there, as well as in other parts of Germany. At a subsequent date (1834) Dr. Julius was dispatched to the United States to inquire into the state of the prisons of that country; and having reported decidedly in favour of the separate system of discipline, that system is likely to be brought into operation in the Prussian dominions. No separate prison has yet been built in Prussia, but we are enabled to state, on the authority of Dr. Julius, that four are about to be built, one at Berlin, another at Königsberg, a third at Münster in Westphalia, and the fourth at Ratisbon. The two first are to be constructed on the plan of the Model Prison at Pentonville.

At Butzow in Mecklenburg a penitentiary has been for some time in operation, which consists of three distinct buildings, the one appropriated to the execution of the silent, the other to that of the separate system, and the third as a place of residence for the governor and superintendants. The first of these buildings contains one hundred and sixty-eight night cells; the second seventy cells adapted for day use. The silent system is applied to minor offenders; the separate to those who have been guilty of grave crimes. At a short distance from this penitentiary there is a prison for the untried.

At Hamburg a plan has been drawn up by director Wummel of a penitentiary similar to that at Butzow; but its adoption is at present doubtful.

The merits of the separate system are differently estimated by the distinguished writers and thinkers of Germany. Professor Mittermaier of Heidelberg has declared his opinion against it on these among other grounds, that its introduction is enormously expensive: that it is difficult to assign to the prisoners in isolation trades or professions by which they will be enabled on their restoration to freedom to obtain an honest subsistence; that, on becoming free, the danger of a prisoner's relapse will be very great after years of isolation in which his powers of resistance have never been taxed owing to the absence of all the temptations of real life. Mittermaier concludes his statement of this last head of objection with the prediction that the liberated offender will infallibly fall into the hands of those who will mislead him anew. (*Revue Etrangère de Législation et d'Economie politique*, Nov. 1836, art. *Du Système Penitentiaire, et des derniers écrits relatifs à la matière qui ont paru à Genève.*)

In Sweden the criminal laws are undergoing revision and the subject of prisons engages corresponding attention. The modes of treating criminals hitherto, and to this time, in use, are of the rudest character. Employment on roads and public works in chains is one form of punishment, and another is public flogging. Burglars only are punished in this way, and the punishment is deemed equivalent to twenty-eight days' confinement on bread and water. Untried prisoners are indiscriminately associated in confined ill-ventilated rooms. But a project is in a fair way of being executed for the erection of a prison on the separate system for the untried; and, instead of the punishments which have been mentioned, prisons on that or on the silent system (more probably the former) are to be built in Stockholm, Fahlun, Gefle, Carlstad, Mariestad, Linköping, and Christianstad. The punishment of death is inflicted in cases of high-treason and murder, and it is allowed by the law, but seldom executed, on offenders guilty of coining money: the mode of inflicting this punishment is beheading.

In Norway the labours of a Prison Commission have resulted in a proposition by the king to the Storthing for the erection of a prison on the separate system, for which a sum of 183,000 dollars (about 40,000*l.* sterling) has been voted. This prison is to be fitted for the reception of two hundred and thirty-eight criminals, and is to be built in the vicinity of Christiania.

In Denmark a project is under consideration for the introduction of improved discipline: but the system remains undetermined.

In Switzerland the construction of the prisons and the systems pursued in them vary to some extent in the different cantons. In those of Geneva and Lausanne the silent system is said to have been carried to a high degree of perfection without the use of corporal punishment. M. Christophe however says that communication between the prisoners is far from being effectually prevented. (*Report*, p. 167-8, &c.) The number of recommitments to the penitentiary of Geneva appears to be considerable: but M. Christophe, coinciding with M. Diodati, chaplain of that penitentiary, appears to regard the number of recommitments as an unsound test of the efficiency of a prison. 'Change (says M. Diodati) the system if you please, redouble at your will its rigours; place the prisoners under the terror of brutal force; make the places of detention, if you can, the wells of Venice or Spielberg; you will always have returned convicts; you will always find men who will hazard this kind of punishment against the kind of misfortune which pursues them in society; and in this unlucky game the prison will not be more their bugbear than their accomplice. The relapsed are then an incurable sore—*une plaie incurable.*' (*Rapport*, p. 173-4.) M. Christophe suggests a different test of the efficiency of systems of punishment. It ought (he says) to be judged rather by the diminution of the number of crimes than by the diminution of the number of the relapsed. We are not sure that this writer consistently keeps in view this test: in his account of the penitentiary of Geneva he refers to circumstances peculiar to Geneva as explaining the large number of recommitments. A good penitentiary system will both reform criminals and prevent crimes; and peculiarities of social condition may account for a large amount of crime, but a large amount of criminal recommitments—in other words, a large number of relapses—cannot be accounted for as a circumstance of long duration excepting in connection with the character of penal institutions.

The penitentiary of Lausanne is represented as being better managed and producing more reform than that of Geneva; but this praise has been bestowed upon the latter in common with the first of these establishments, that discipline is better maintained in it, and that the moral reform of the prisoner is promoted more than in any of the prisons on the same system in Europe or America. The prisons of Berne are regulated on the principle of silence also, but they allow of more association among the prisoners than is the case in those of Lausanne and Geneva, and the same meed of praise has not been accorded to them as to the above-mentioned penitentiaries by those competent to form a judgment of both.

A prison on the separate system is now in progress of erection at Geneva.

TRANSPORTATION, the name used to designate banishment when used as a punishment of offenders by the law of England. It is a punishment altogether created by statute, although, by the common law, criminals who had taken refuge in sanctuary were permitted to abjure the realm, and banish themselves, proceeding for that purpose to the port assigned them. [SANCTUARY.] The earliest statute by which transportation was inflicted appears to be the 39 Eliz., c. 4, which enacted that rogues and vagabonds, &c. might be banished out of the realm by the justices in sessions, and conveyed, at the charge of the county, to such parts beyond the seas as should be assigned by the privy council, or otherwise adjudged perpetually to the galleys of this realm; and any rogue so banished, and returning again into the realm, was to be held guilty of felony. The general principle of this first enactment seems to have been observed ever since. Soon after the restoration of Charles II., a practice was introduced in cases of conviction for felony, where the convict was liable to the punishment of death, of granting a pardon, on condition that the convict should consent to be banished either for his life or a less time. The full sentence of the law was passed upon the convict, and, on the breach of the condition under which he obtained his pardon, the sentence was held to revive, and might be executed upon him. Convicts thus banished were assigned, under indentures, to persons residing in the North American colonies, then generally called the plantations. These persons were entitled to their labour during the period of the indentures, paying, the latter part of the time, a certain amount of wages. At the end of it the convicts received from the government some land and stock. By the 22 Ch. II., c. 5, judges and justices before whom an offender is convicted are first expressly empowered to grant him a reprieve, and transport him to the plantations, there to be kept to hard labour. If he refuses to be transported, or returns before the expiration of the time, he is to be put to execution upon the judgment pronounced. The Habeas Corpus Act, 31 Ch. II., c. 2, s. 14, recognises the existence of this power. By the 4 Geo. I., c. 11, transportation is substituted as a punishment for a variety of offences there named, in lieu of burning in the hand, whipping, &c. Many other acts have been since passed determining the offences punishable by transportation, regulating the mode in which the sentence is to be carried into effect, the services of the transports assigned, &c. By 27 Geo. III., c. 2, it having become necessary, in consequence of the independence of America, to appoint a new place for the reception of convicts, and New South Wales having been selected, the governor there was enabled to receive them, hold courts for their trial in case of subsequent offences, &c. The law regulating the transportation of offenders has been since revised and consolidated into one act, the 5 Geo. IV., c. 84 (amended by 11 Geo. IV. and 1 Will. IV., c. 39), which contains the principal provisions now in force on the subject. The 6 Geo. IV., c. 69, regulates the punishment of offences committed by transports sent to labour in the colonies. The governors of such colonies have power to lessen the period for which a convict is transported; but by 2 and 3 Will. IV., c. 62, the extent to which they can do this is limited in the cases of transportation for seven, fourteen years, and for life, to a remission of the punishment to four, six, and eight years respectively. Persons rescuing or aiding a transport to escape are guilty of the same offence as if he had been confined in gaol.

(Hawkins, *P. C.*, b. 2, c. 33; Russell, *On Crimes and Misdemeanours*, b. 2, c. 35.)

TRANSPOSITION, the name given in algebra to the process of removing a term from one side of an equation to another, changing its sign. Thus, if $a=b+c$, by transposition, $a-c=b$. On this we have only to remark, that in this instance the rule is not much of an abbreviation. If we say 'transpose c,' instead of 'take c from both sides,' so little is gained, that it may be doubted whether it would not be better to follow the Continental writers in the use of the latter form of expression: a process which would have the advantage of being a perpetual appeal to reason instead of rule.

TRANSUBSTANTIATION. [SACRAMENTS.]

TRANSVERSAL, a name lately given to a line which is drawn across several others, so as to cut them all. The word is used in this sense in the writings of Carnot, Poncelet, Chasles, &c.

Let there be a triangle ABC (the reader may easily draw the figures of this article for himself) and let a transversal cut its three sides internally or externally; namely, let AB cut the transversal in c, BC in a, and CA in b. Then will

$$\mathrm{A}c \times \mathrm{B}a \times \mathrm{C}b = \mathrm{B}c \times \mathrm{C}a \times \mathrm{A}b;$$

and the converse, namely, if a, b, c, be points taken on the three sides for which the above relation is true, then those three points are on the same straight line. In the language of Euclid, the ratio compounded of the three ratios of $\mathrm{A}c$ to $\mathrm{B}c$, $\mathrm{B}a$ to $\mathrm{C}a$, and $\mathrm{C}b$ to $\mathrm{A}b$, is the ratio of a line to its equal.

This proposition is now frequently demonstrated in elementary works on geometry as follows:—From any one of the vertical points A, B, C, draw a parallel to either of the sides of the triangle which does not pass through that point; from C, for instance, draw cM parallel to AB, cutting the transversal in M. Then we have two pairs of similar triangles, MCb, cAb, and aBc, aCM, which give

$$a\mathrm{C} : \mathrm{CM} :: a\mathrm{B} : \mathrm{B}c$$
$$\mathrm{CM} : \mathrm{C}b :: \mathrm{A}c : \mathrm{A}b$$
$$\text{or } \mathrm{C}a : \mathrm{C}b :: \mathrm{A}c \times \mathrm{B}a : \mathrm{A}b \times \mathrm{B}c;$$

whence the proposition required is obvious. The converse readily follows by indirect demonstration.

Let any point P be taken inside or outside of the triangle ABC, and let AP, BP, CP cut BC, CA, AB in a, b, c. Then

$$\mathrm{A}c \times \mathrm{B}a \times \mathrm{C}b = \mathrm{B}a \times \mathrm{C}b \times \mathrm{A}c,$$

which is proved by using the former property in the triangle ABa with the transversal CPc, and the triangle AaC with the transversal BPb. The converse is also easily proved, namely, that if a, b, c be so taken on the sides as to satisfy the above relation, then Aa, Bb, Cc all meet in one point.

The same proposition as the first is true of any polygon whatsoever: thus, let ABCDE be a pentagon, the sides of which are cut externally or internally by a line, namely, AB in c, BC in d, CD in e, DE in a, EA in b; then

$$\mathrm{A}b\,.\,\mathrm{B}c\,.\,\mathrm{C}d\,.\,\mathrm{D}e\,.\,\mathrm{E}a = \mathrm{A}c\,.\,\mathrm{B}d\,.\,\mathrm{C}e\,.\,\mathrm{D}a\,.\,\mathrm{E}b.$$

For let BD and BE meet the transversal in m and n: then the three triangles BDC, BED, BAE are cut by a transversal, giving

$$\mathrm{B}m\,.\,\mathrm{D}e\,.\,\mathrm{C}d = \mathrm{D}m\,.\,\mathrm{C}e\,.\,\mathrm{B}d$$
$$\mathrm{D}m\,.\,\mathrm{E}a\,.\,\mathrm{B}n = \mathrm{B}m\,.\,\mathrm{D}a\,.\,\mathrm{E}n$$
$$\mathrm{E}n\,.\,\mathrm{A}b\,.\,\mathrm{B}c = \mathrm{B}n\,.\,\mathrm{E}b\,.\,\mathrm{A}c;$$

by multiplication of which the theorem follows.

If the transversal be parallel to either of the sides, the two segments, which are then infinite, are to be considered as equal, and removed from both sides of the equation.

In the article PROJECTION a test is given which, being satisfied, shows that a proposition is true of any figure, if it be true of any one of its projections. This test is satisfied in all the preceding cases, so that it is enough to prove any one case of these propositions, that is, for any one projection of the figure. Now there is no case in which they are obviously true, *à priori*, except for that projection in which the transversal becomes the vanishing line, or all the segments become infinite. If we put the first proposition of all in this form

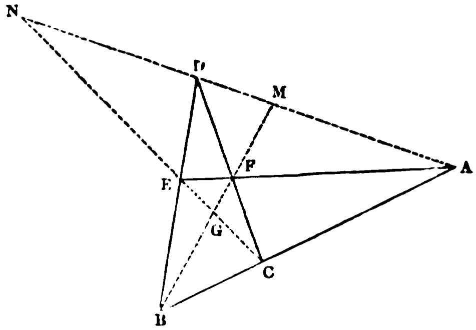
$$\frac{\mathrm{A}c}{\mathrm{A}b}\cdot\frac{\mathrm{B}a}{\mathrm{B}c}\cdot\frac{\mathrm{C}b}{\mathrm{C}a} = 1,$$

it is obviously true when the line abc is at an infinite distance, each of the ratios being then unity. It would not be safe, upon the proof given in the article cited, to allow this extreme case of projection to enter into the theorem: nevertheless, other proof might be given, which would make this very simple and perceptible instance, the truth of which is seen at once, sufficient evidence of all the others. We mention this only to show the very great power of the geometry of projections: our limits do not allow of our entering further into the subject.

The theory of transversals may be made useful in surveying, particularly in military surveying: as an instance take the following. There is an inaccessible point A, from which to B it is required to find the distance without any instruments except signal-poles and a measuring-line. At B set up a signal, and another, C, at a convenient distance between B and A. Choose another signal-point, D, and between D and B set up a signal at E, and another at F, between D and C, and also between E and A. All this must be done by trial. Then measure DE, EB, DF, FC, and BC. The triangle DBC, cut by the transversal EFA, gives the following relation:—

$$\mathrm{DE}\,.\,\mathrm{BA}\,.\,\mathrm{CF} = \mathrm{EB}\,.\,\mathrm{CA}\,.\,\mathrm{FD}$$
$$\text{or } \mathrm{DE}\,.\,\mathrm{CF}\,.\,\mathrm{BA} = \mathrm{EB}\,.\,\mathrm{FD}\,(\mathrm{BA}-\mathrm{BC})$$
$$\text{whence } \mathrm{BA} = \frac{\mathrm{EB}\,.\,\mathrm{FD}\,.\,\mathrm{BC}}{\mathrm{EB}\,.\,\mathrm{FD}-\mathrm{DE}\,.\,\mathrm{CF}}$$

The projection of figures may throw them into such different forms that lines which, in Euclid's mode of speaking, would be called sides, become diagonals, and *vice versâ*. The distinction of diagonal and side therefore becomes an incumbrance, and a new mode of viewing polygons is introduced, of which we shall now give an instance. A figure contained by four straight lines is, generally speaking, one which has six points: since four straight lines meet two and two in six points; thus, the four-sided figure EFBC has the six points E, F, B, C, D, A. If all these points be joined two and two, we have the additional lines BF, CE, DA, of which only the two first are commonly called diagonals: but all three have common properties. We shall prove the following by the extreme method of projection already alluded to, leaving the reader



to verify it by the theory of transversals: each of the diagonals is harmonically divided by the other two; that is,

AM : MD :: AN : ND
CG : GE :: CN : NE
BG : GF :: BM : MF

To show the first: project the figure so that NB shall be the vanishing line. Then DECA will be projected into a parallelogram and MG into a parallel to DE and AC passing through the intersection of the diagonals: consequently, in the projection, AM = MD, and we have, also in the projection,

$$\frac{AM}{MD}\cdot\frac{DN}{NA}=1;$$

for DN and NA are both infinite, and DN ÷ NA is unity. Now by the test in Projection, which is here satisfied, this proposition must be always true, whence in our figure we have AM : MD :: AN : ND. Similarly the other proportions may be proved.

Here then is the easiest way of dividing a line in harmonic proportion. Let AD be given, and M: it is required to complete the harmonic division by finding N. Take any point, B, and draw DB, MB, AB. Choose any point, F, in MB, and produce DF and AF to C and E. Then CE produced to meet AD will give the point N required. No instrument is wanted, except the ruler and pencil, and it is a good exercise in drawing to find out by repeated instances that, let B be taken where it may, there is but one position of N.

TRANSVERSE, a name often given to one of the axes of a figure, usually that of greatest magnitude or which goes most directly across the figure. Thus the longer axis of an ellipse or hyperbola is called the transverse axis. Properly speaking, it ought to be only a term of relative distinction: either axis is transverse to the other.

TRANSYLVA'NIA, a grand principality belonging to the Austrian empire. It lies between 45° 12′ and 47° 42′ N. lat., and 22° 15′ and 26° 20′ E. long.: its greatest length from north-west to south-east is 194 miles, and its greatest breadth from west to east is 184 miles. According to Lichtenstein, who wrote in the beginning of this century, the area of Transylvania does not exceed 880 German square miles, or 18,708 English; but according to the last edition of Malte-Brun, the area is 1109.80 German square miles, or 23,480 English. However, from this amount we must deduct the area of three counties, the possession of which is claimed by Hungary, and of which we shall speak below. Transylvania is bounded on the north by the Hungarian counties of Marmaros and Szatmar, on the east by Bukowina and Moldavia, on the south by Wallachia, and on the west by the Hungarian military frontier, and by the counties of Krasso, Arad, and Bihar.

Transylvania is the western part of the Roman Dacia. The name Transylvania has been given to the country by the Hungarians, who called it 'Terra ultra sylvas,' or 'Partes transylvaniæ,' that is, 'the country beyond the woods:' extensive woody mountains separate Transylvania from Hungary. However the true Hungarian name is 'Erdély-Orzag,' or 'the woody country.' The German name is 'Siebenbürgen,' which signifies either the 'Seven Castles' or the 'Seven Boroughs.'

Mountains.—The range of the Carpathian Mountains having been described under Carpathian Mountains, we shall only mention the passes by which that range is crossed, and which are of great military importance, being the only ways of communication between Transylvania on one side, and Moldavia and Wallachia on the other side. The following lead to Wallachia:—1. The pass of Zaikan in the valley of the Hatzeg, in the county of Hunyad. This pass is called the 'Iron Door' on account of the high and steep rocks by which it is bounded. 2. The pass of Valkan, near the village of Krivadia, in the county of Hunyad, famous for the bloody defeats which the Turks have suffered there in different wars. 3. The pass of the Rothen-Thurm, or the 'Red Tower,' the most remarkable of all. Formed by the narrow valley of the Alt, it begins near the village of Boitza or Ochsenkopf in Transylvania and it ends near the convent of Kosia in Wallachia. The length of this pass is eleven leagues, and the greater part of the road is hewn in the rock. 4. The pass of Fortschwar or Terzburg in the district of Kronstadt. 5. The pass of Tomosch, south of Kronstadt, formed by the valley of the river Tomosch. 6. The pass of Bosau in the district of Kronstadt. The passes of Oytosch, Gymesch, and Paritsch, or Bereczk, lead into Moldavia, and the Borgo pass makes the communication with Bukowina.

Transylvania is a table-land, bounded on the east and the south by the principal range of the Carpathians; on the north by a branch of the Carpathians, which beginning at Mount Gallatz, stretches westward as far as Mount Pleska, and thence to the north-west as far as Mount Pretrosza in Hungary; and on the west by an extensive system of mountains which is composed of three large groups. The first or southern group begins near Mount Kosztara, in 45° 13′ N. lat. and 22° 40′ E. long., stretching to the north as far as the river Maros: the centre of this group, Mount Ruska-Poyana, is 9300 feet, or perhaps 9900 feet high. The second group lies between the Maros in the south, and 47° N. lat. in the north, sending out lofty and extensive branches to the east and to the west. The third group begins in 47° N. lat., and stretches as far as 47° 35′ N. lat.; the southern part of it is called the Reuss-Mountains, and the northern part known by the German name of the Buch-Gebirge. Between the northern slopes of the Buch-Gebirge and Mount Pleska in the east, lies the valley of the Szamos, which is one of the few larger passes between Transylvania and Hungary, another being formed by the valley of the river Maros. Inclosed by high and woody mountains, and containing the sources of a multitude of rivers, Transylvania has a striking resemblance to Bohemia, although her natural barriers present more difficult obstacles. The middle of Transylvania is traversed by several parallel ranges of mountains, which, being links between the Carpathians in the east, and the Hungaro-Transylvania mountains on the frontier in the west, give to the country the aspect of a gigantic gridiron. The direction of these ranges is generally from north-east to south-west; the elevation of the summits is less than that of the Carpathians, and in many districts they are mere hills. The first or northern of these ranges begins at Mount Bistriksora in the east, and joins the western system in 46° 30′ N. lat.; it is not interrupted by any river or plain, and separates the valley of the Szamos, or the northernmost part of the country, from the valley of the Maros. The second lies between the Maros and the river Little Kockel; the third is between the Little Kockel and the Great Kockel; and the fourth forms a barrier between the Great Kockel and the river Alt. Plains are rare in Transylvania. Extensive tracts of the hilly and mountainous parts are covered with forests, the largest of which are those of Ricka, Hargit, Parayde, Mikoane, and Zeidne.

Rivers.—All the rivers of Transylvania are tributaries of the Danube, either flowing directly into this river, or joining the Theiss; a few, of little importance, join other affluents of the Danube. 1. The Marosh (Maros) has its sources on the eastern frontier at the foot of Mount Tarko or Tatarrhago. It runs first north-west and west for about 46 miles, and afterwards south-west, west, and south-south-west for upwards of 100 miles till it reaches Karlsburg; from this town to its junction with the Theiss at Szegedin it has a generally west course. The whole length of this river is above 300 miles, but its course within Transylvania is only from 180 to 190 miles. The mouth of the Maros at Szegedin is 600 feet wide, and it becomes navigable for boats at Karlsburg: it contains abundance of fish, and it brings down particles of gold. The most important of its southern tributary rivers is the Great Kockel (Küküllo), which receives the Little Kockel (Küküllo).

On its northern side the Maros receives the Aranyos, which has its sources in the west on the frontiers of Hungary, and which flows eastwards in a direction opposite to that of the Maros. The latter part of the Aranyos is navigable. 2. The Samosh (Szamos) is formed by the junction of the Great and the Little Szamos. The Great Szamos comes from Mount Kahlberg, or Gallatz, in the district of Bistritz, in the north-eastern corner of Transylvania, and runs south-west as far as Deez, where it is joined by the Little Szamos, the sources of which are at the foot of Mount Kalata, in the district of Klausenburg, on the frontiers of Hungary. The direction of the Little Szamos is north-east.

From Deez the united stream of the two Szamos first runs north-west, then south-west, and at last north, till it reaches the frontiers of Hungary a little above Szada: it joins the Theiss at the village of Apati. The whole length of the Szamos is upwards of 200 miles, and three-fourths of its length are within Transylvania. 3. The sources of the Alt (Aluta) are in a part of the Carpathians called Nagy-Hagyrnas, a little distance south of the sources of the Great Szamos. The Alt runs at first from north to south in an alpine valley bordered by high and steep rocks, till it reaches the limits of the district of Kronstadt, near Illyefalva. There it turns suddenly to the north-north-west, but soon again changes its direction, which is south-west and west, as far as the southern environs of Hermannstadt, where it turns to the south, and keeps this direction through the pass of the Rothen-Thurm, and as far as its junction with the Danube opposite Nikopoli. The length of the Alt is about 250 miles, and about 134 miles are within Transylvania. The navigation on the Alt within Transylvania has many obstacles, the bed of the river being full of rocks, part of which however have been blown up by order of the Austrian government. This river affords a natural communication between Southern Transylvania and Wallachia and the Danube, and is therefore of great importance for commerce, especially as the valley of the Alt is the most fertile and the most civilized part of Transylvania, being almost entirely inhabited by German colonists. The Danube being sufficiently deep for sea-ships at Nikopoli, any productions of foreign countries might be sent direct to that town, whence they could be transported by means of boats into the very heart of Transylvania. But the government of Wallachia is far from imitating the Austrian government in its care for the navigation of the Alt, and the whole Wallachian part of this river is still in a state of primitive wildness. There are some lakes of importance. The lake of Hados in the county of Doboka is 15 miles long; the lake of St. Anna near Lazarfalva in the country of the Szeklers is 10 miles long and as many broad; the lake of Piritsch in the Carpathians is renowned for the gas which its surface exhales, and which suffocates birds that fly over it: the Holt-Maros is a lake formed by the Maros near Karlsburg.

Climate.—The temperature is generally very variable. Severe cold varies with extreme heat: the summer days are very hot, especially in the valleys and in the western and southern parts of the country, and the nights are cold; in the winter the cold is almost insupportable. In the east the temperature is wet and cold, and not favourable for grain. Cold winds prevail in the spring and autumn, and they blow with great regularity. Dreadful storms followed by sudden severe cold are frequent; they have given the name to a district called Burzenland, or 'the country of the storms.' The regular winds have different names in different districts: in the district of Hermannstadt they are called winds of the Rothen-Thurm, because they blow from south to north, bursting with irresistible violence through the northern opening of that long defile; in the district of Haromszek they are called Nenewinds; and in the country of the Szeklers they have the name of the winds of Thorda-hashadek. Notwithstanding these phenomena Transylvania produces abundance of fruits of all kinds.

Soil, Productions, and Commerce.—The southern and western parts are intersected by hills which contain pleasant valleys, and the soil is of great fertility: the eastern and northern parts and a narrow tract along the western frontier are covered with forests, and the soil is stony in many districts; but even the stony surface is covered with a layer of soil which renders it fit for agriculture. The country is far from being equally well cultivated in all parts. Transylvania produced, in 1834, iron, 51,238 cwt.; lead, 2353 cwt.; copper, 906 cwt.; quicksilver, 26 cwt.; sulphur, 38 cwt.; silver, 5431 marks; gold, 3030 marks; rock-salt, in six mines, 770,706 cwt.; the greater part of which is exported to Hungary and Bukowina; salt, from 112 salines. There are serpentine, topazes, chrysolites, emeralds, and amethysts in the high mountains; agates, opals, chalcedony, and carnelians in the hills and rivers. The mineral-waters are celebrated. Besides enormous quantities of timber, Transylvania produces wheat, barley, corn, oats, millet, and maize; apples, pears, and other fruits in abundance; wine, especially in the valley of the Alt, of excellent quality, though not so strong as the Hungarian wine; tobacco, of very good quality and in abundance, especially in the valley of the Alt. The breeding of cattle chiefly occupies the Wallachians in Transylvania: sheep are numerous, and their flesh has that aromatic taste which distinguishes the sheep that feed on the mountainous pasture-grounds of southern Europe. There are fish, wild and tame fowl, and game of all sorts, in abundance; wolves are frequent in the Carpathians, and even bears and lynxes appear. The horses are of small size, but swift, and very fit for light cavalry. Manufactures scarcely exist, except in the valley of the Alt, where the Germans produce some fine dyed cloths and cotton, fine felt-hats, and leather-ware, and a considerable quantity of linen. The commerce with Wallachia, Moldavia, and Turkey is of some importance, and there are hopes that it will increase in proportion with the progress of navigation on the Danube. Sulzer states that towards the end of the past century the commerce of Transylvania was almost destroyed; but the commerce of the Black Sea having greatly increased since that time, even Transylvania has felt the favourable influence of this circumstance, notwithstanding the prohibitory tariff of the Austrian government. At present the manufactures are in the hands of the Germans, and commerce is carried on by Greeks and Armenians. The total value of the exports in 1834 was 346,243*l.*, and that of the imports was 222,472*l.* The total length of good roads in 1834 was 248 Austrian post-miles, or 966 English miles.

Political Divisions and Population.—Transylvania is divided into three political divisions, viz. 1, The country of the Hungarians; 2, The country of the Szeklers; 3, The country of the Saxons. The population of these three countries in 1832 was 2,092,200 inhabitants.

1. The country of the Hungarians occupies the northern, middle, and south-western parts of Transylvania; it is divided into 11 counties (comitatus) and 2 districts. The counties are—1, Hunyad, area 2259 English square miles, 151,226 inhabitants in 1832; 2, Zarand, 541 square miles, 47,267 inhabitants; 3, Kraschna (Krasna), 420 square miles, 61,784 inhabitants; 4, Mittel-Szolnok (Köszep-Szolnok), 841 square miles, 104,901 inhabitants; 5, Unter-Szolnok (Bellö-Szolnok), 1337 square miles, 130,157 inhabitants; 6, Debok (Doboka), 1166 square miles, 111,513 inhabitants; 7, Klausenburg (Kolos), 1934 square miles, 141,060 inhabitants; 8, Thorenburg (Thorda), 1853 square miles, 152,351 inhabitants; 9, Kockelburg (Kükullo), 596 square miles, 56,480 inhabitants; 10, Unter-Weissenburg (Alsö-feyer), 1966 square miles, 99,445 inhabitants; 11, Ober-Weissenburg (Felsö-feyer), 645 square miles, 49,426 inhabitants. Districts: 1, Fagarosch (Fagaros), 681 square miles, 76,182 inhabitants; 2, Kowar, 386 square miles, 54,061 inhabitants.

The counties of Zarand, Mittel-Szolnok, and Kraschna are to be, or have already been, ceded to Hungary. As their area contains 1802 English square miles, with 213,952 inhabitants, the surface of Transylvania after the cession will not reach 1024·90 geographical, or 21,678 English, square miles, with 1,878,248 inhabitants.

The principal towns of the country of the Hungarians are—Klausenburg (Kolosvar), on the Little Szamos [CLAUSENBURG]. Karlsburg or Weissenburg (in Latin, Alba-Julia; in Hungarian, Gyuta-Fejervar; in Slavonic, Bialogrod), a strongly fortified town, with 6000 inhabitants, on the Maros: it has a mint, observatory, public library, and is the seat of the Roman Catholic bishop of Transylvania. In the environs are the richest gold-mines of Europe, the principal among which are those of Szekeremb, Zalathna or Golden Markt, Abrudbanya, and Veröspatak; it is said that the gold and silver mines of Veröspatak were known to the Romans. Nagy-Enyed, with 6000 inhabitants, and a college, which is the principal school for those of the Reformed religion. Varhely (Gredistye) is in the beautiful valley of the Hatzeg, in the county of Hunyad, on the site of Zarmice-Gethusa, the capital of the antient Dacians, and the Ulpia Trajana of the Romans. The environs are full of Roman antiquities, among which the most remarkable are the remains of an amphitheatre, and the foundation of a Roman house containing the pavement of two rooms, which are in fine mosaic representing scenes from the Greek mythology. This house was discovered in 1823. Thorenburg (Thorda), with 6000 inhabitants, has rich mines of rock-salt, which produce 240,000 cwt. per annum.

2. The country of the Szeklers (Pars Siculorum) extends along the eastern frontier or the range of the Carpathians, and is bounded on the north and north-west by part of the country of the Hungarians; on the north-east and east by Moldavia; on the south-east and south by Wallachia; and on the west and south-west by a small part of the country of the Hungarians and by the country of the Saxons. It contains five ‘Jurisdictions,’ viz. 1, Aranyosh (Aranyos), 128 English square miles, 21,969 inhabitants; 2, Neumarkt or Marosch (Maros), 615 square miles, 57,611 inhabitants; 3, Udhavely, 1082 square miles, 46,576 inhabitants; 4, Csik (Csik-Szeke), 1806 square miles, 93,383 inhabitants; 5, Haromschek (Haromsek), 1887 square miles, 82,686 inhabitants. The principal town is Neumarkt (Maros-Vazarhely), with 10,000 inhabitants: it contains the chief seat of justice of the country of the Szeklers, a Roman Catholic gymnasium, a Reformed college, a mineralogical museum, and a public library, the largest and best in Transylvania. Szekely-Udharvely has 6000 inhabitants. Gyorgiö St. Miklos, Sepsi St. György, and Felvinez are small towns.

3. The country of the Saxons. The main or southern part of it is bounded on the east and north-east by the country of the Szeklers; on the north and west by the country of the Hungarians; and in the south by Wallachia. Another smaller part, the district of Bistritz, lies in the north-eastern corner of Transylvania, on the frontier of Bukowina. The country of the Saxons is divided into nine Jurisdictions and two districts. Jurisdictions: 1, Reps or Rappes (Kö-halom), 227 English square miles, 31,000 inhabitants; 2, Schässburg (Segesvar), 219 square miles, 27,391 inhabitants; 3, Gross-Schenk (Nagy-Senk), 246 square miles, 31,482 inhabitants; 4, Mediasch or Medwisch (Medgyas), 257 square miles, 37,908 inhabitants; 5, Leschkirch (Vj-Egyhaz), 123 square miles, 18,950 inhabitants; 6, Hermannstadt (Szeben-Szeke), 788 square miles, 99,921 inhabitants; 7, Reismarkt (Szerhadely), 81 square miles, 21,813 inhabitants; 8, Mühlenbach (Szasz-Sebes), 119 square miles, 18,104 inhabitants; 9, Broos (Szasz-Varos), 172 square miles, 21,989 inhabitants. Districts: 1, Bistritz (Beszterez), 1215 square miles, 109,534 inhabitants; 2, Kronstadt (Brasso-Videke), 692 square miles, 81,786 inhabitants.

The popular division of the country of the Saxons is as follows:—1, Weinland, with the capital Schässburg; 2, Altland, with the capital Hermannstadt; 3, Land vor dem Walde, with the capital Mühlenbach; 4, Burzenland, with the capital Kronstadt.

The principal towns of the country of the Saxons are the following: Hermannstadt (in Hungarian, Nagy-Szeben; in Latin, Cibinium), the capital of Transylvania with regard to administration and finances, is said to have been built by a certain Hermann of Nürnberg, one of the leaders of the first German colonists, who came to Transylvania between 1101 and 1103. The town is situated on the river Ziblin, a short distance north-west of the Alt, in the west part of the country of the Saxons, and is surrounded by most beautiful environs. It has upwards of 20,000 inhabitants, among whom there are about 9000 Lutherans. It consists of two parts; the upper town, situated on a hill with an old fortress, and the lower town, which lies at the foot of this hill: they are enclosed by a double wall. The market-place is very fine, and the streets are regular. The most remarkable buildings are—the Lutheran cathedral, built in 1460; the palace of Brückenthal, containing the Brückenthal gymnasium, a museum, a public library, and a room with 18,000 medals, and a fine collection of antiquities, among which there are many Roman remains found in Transylvania; and the town-hall, an old Gothic building of beautiful workmanship, which is the meeting-house of the Saxon nation, and contains the archives of the Saxons. Among the public institutions the most remarkable are—two gymnasia, two national schools, two orphan-houses, an establishment for military education, four hospitals, one military hospital, a poorhouse a workhouse. Hermannstadt is the seat of the ‘thesauriat, or the court of finance of Transylvania; and the residence of the commander-in-chief of the Austrian forces in Transylvania, and of a Greek bishop and his chapter. The inhabitants fabricate 40,000 pieces of cloth per annum, more than one million horn-combs, much leather, and some paper and gunpowder; there are two printing-offices, and one publisher. In the environs there are several places for bleaching wax. The village of Heltau near Hermannstadt is renowned for the gigantic size of its inhabitants. The town is chiefly inhabited by Germans, but the population of the three suburbs is composed of Wallachians. Kronstadt [Cronstadt]. Schässburg (Segesvar), on the Great Kockel, in a beautiful valley, with 6000 inhabitants, has manufactories of cotton and cloth; wine is made in the environs. Bistritz (Beszterez), on the river Bistritz, opposite to the Borgo Pass, has 5000 inhabitants, who fabricate cloth, leather, and soap, and carry on commerce with Bukowina, Austrian Poland, and Moldavia.

That tract of Transylvania which lies on the frontier of Moldavia and Wallachia belongs to the Austrian military frontier [Military Frontier], and has a separate administration with regard to military affairs.

Inhabitants.—The inhabitants belong to different nations. According to Malte-Brun there are, 526,000 Hungarians (Magyars and Szeklers); 483,000 Saxons; 920,000 Wallachians; 80,000 gipsies; 10,000 Slavonians; 6000 Armenians; and 2000 Italians. The statements of the duke of Ragusa (Marshal Marmont) about the number of the different nations in Transylvania are generally too high; according to him there are 120,000 Armenians, which is manifesting a gross error. The difference of nationality is of high importance in Transylvania, for the political rights of the individuals depend upon their origin.

Constitution.—The nation in the political sense of the word is composed of three bodies or ‘nations,’ the Hungarians, the Szeklers, and the Saxons, who have the collective name of the ‘Uniti.’ But political rights are not only personal, they are also territorial: if for instance a member of the body of the Hungarians settles in the country of the Saxons, he will cease to belong to the Hungarian body, and will be entitled to the rights of a Saxon, without prejudice however to his personal rights as a nobleman. The Saxons having no nobles among them, a Saxon who settles in the country of the Hungarians will be entitled to the rights of a Hungarian, but he will not become noble, and therefore not acquire those privileges which depend upon nobility. The privilege of nobility is personal and territorial in this sense, that if any freeman of the three nations acquires a ‘noble estate’ he will have the political rights of a nobleman. The Wallachians have no political rights, but they have lately ceased to be serfs; some families among them are of antient freedom, and others belong to their national nobility, but they do not possess any political rights unless they are received among the Hungarian or Szekler nobility, or become citizens among the Saxons. When a Hungarian or Szekler nobleman of Transylvania settles in Hungary, he is entitled to all the privileges of noblemen in Hungary, but the nobles of Hungary do not acquire the same privileges with regard to Transylvania when they settle there. The principal privilege of the nobles is exemption from taxes. The ‘Armalists’ however, or those petty nobles who possess no noble estates, pay taxes, and so do the Saxons, and generally all the rest of the people, except the clergy. The different charters of the Transylvanian constitution are as follow:—1, the ‘Puncta Unionis’ of 1542-3; 2, the ‘Diploma Leopoldinum’ of the 4th of June, 1691; 3, the ‘Sanctio Pragmatica’ from 1744; 4, the ‘Articuli diaetales.’ The high commission which is intrusted with the administration of Transylvania sits in Vienna, and is called ‘Die hohe Siebenbürgische Hof-Kanzlei,” or the high chancery of Transylvania, which is under the immediate control of the emperor and his ministry. Transylvania is in every respect separated from and independent of Hungary, and the emperor styles himself grand-prince of Transylvania. The revenue of Transylvania in 1834 amounted to 325,400*l*., of which the revenue from the post-office was only 90*l*.

History.—The early history of Transylvania has been given under Dacia. From the fifth century it was successively occupied by different nations [Goths; Attila;

HUNS], and remained at last in the hands of the Polovzians, or Petshenegues, who were a Turkish tribe. When the Hungarians or Magyars conquered the country between the Carpathians and Germany, they also settled in Transylvania and subdued or drove out the Petshenegues. However Transylvania became independent of Hungary until it was conquered by King Stephen I. in 1004. It then became a part of Hungary [HUNGARY], and continued so until the civil troubles of this country became the cause of the independence of Transylvania. John Zapolya disputing the crown of Hungary with Ferdinand of Austria, afterwards emperor under the name of Ferdinand I., was supported by the Turks, and he at last compelled Ferdinand to allow him to possess Transylvania as an independent principality.

But Zapolya was forced in his turn to acknowledge himself a vassal of the Osmanlis. During 150 years Transylvania was governed by princes of the houses of Zapolya and Bathori, and some of her princes, especially Betlen Gabor and George Ragozi were dangerous enemies of the house of Austria. [THIRTY YEARS' WAR.] Leopold I. conquered Transylvania in 1687, and the Porte was obliged to renounce her supremacy over it by the peace of Carlowitz in 1699. Transylvania however became only a vassal state of Austria, until the death of her last prince, Michael Apafi II., who died in 1713. In 1765 the empress Maria Theresa erected Transylvania into a grand-principality.

After the conquest of Transylvania by Stephen I., the country was almost entirely depopulated, but it was gradually repeopled by foreign colonists. The first arrival of the German colonists is generally said to have taken place under King Geysa II. in 1143, but in fact they came in earlier. These German colonists came from Westphalia, the Lower Rhine, and the Low Countries, some also from Lower Saxony, and they were called Saxons, either because they generally spoke the low German language, or because several northern nations, especially the Finns, called, and still call, the Germans by the name of Saxons. The number of these colonists, who received great privileges, was augmented after the Reformation by Protestant refugees from different parts of Germany, and chiefly in 1739, after the archbishop of Salzburg had expelled all his Protestant subjects. The Germans are the most civilized inhabitants of Transylvania, and though separated from their fatherland by an extensive and half-barbarous country, they still keep up a connection with Germany. The German universities are frequented by a considerable number of Transylvanian students, especially for divinity. The Szeklers are said to be the descendants of the Turkish Petshenegues, who were allowed to remain in the country on condition of guarding the frontier against the invasions of the eastern barbarians; but they are now quite Hungarians. The important question whether the Wallachians, who are so numerous in Transylvania, are the descendants of the Roman colonists in Dacia, belongs to the history of Wallachia. [WALLACHIA.]

(Marienburg, *Geographie des Grossfürstenthums Siebenbürgen;* Scheint, *Das Land und Volk der Szekler;* Schlözer, *Die Deutschen in Siebenbürgen;* Sulzer, *Transalpinisches Dacien* (although this book treats principally of the history of the Wallachians beyond the Carpathians, it contains very valuable notions concerning Transylvania, where the author lived thirty years); Demian, *Tableau Géographique et Statistique des Royaumes de Hongrie, &c., et de la Grande-Principauté de Transylvanie*, translated from the German; *Der Verfassungs-Zustand der Sächsischen Nation in Siebenbürgen*, Hermannstadt, 1790, 8vo.; Lenk von Treuenfeld, General-Feldmarschall-Lieutenant, *Siebenbürgens geographisch-topographisch-statistisch-hydrographisch-orographisches Lexicon*, 3 vols. 8vo., 1839. (This book is written with great care; of every village the author mentions the different nations by which it is inhabited, but it does not contain the number of inhabitants. An inconvenience for foreign readers is that the Hungarian names are put at the head of the articles, although the German names are much more known. He who seeks for Hermannstadt must look for Nagy-Szeben.)

TRAP. This geological term, one of the most general use and comprehensive signification, seems to have been originally employed by Bergman and the German and Swedish miners, in the sense of the word '*trappa*,' Swedish, or '*treppe*,' German, meaning stairs, and the aspect of the rocks now called Trap, in successive terraces on hill sides, is such as often to justify the use of the word. In modern works on topographical geology a very great proportion of the antient rocks of fusion are familiarly called 'Trap,' not because they have any certain mineral composition, but because, whether granitic, sienitic, porphyritic, or hornblendic, they appear under particular relations of position or geological age. In this sense the term is purely geological, and we have as distinctive designations 'eruptive trap,' 'contemporaneous trap,' 'overlying trap,' 'interposed trap,' &c. By other writers the term is restricted so as to leave out such massive and generally deep-seated rocks as granite, or even contracted to the hornblendic and felspatho-hornblendic rocks, which appear as dykes, interposed beds, and overlying masses. It thus appears to be a collective term more convenient than precise. In a geological sense it may be replaced by descriptive words, such as 'irruptive,' 'interposed,' 'overlying,' &c., and in a mineralogical sense it is advantageously changed for 'basalt,' 'greenstone,' 'felsparite,' 'sienite,' 'serpentine,' 'diallage rock,' &c. (MacCulloch *On Rocks*.)

TRAPA, a genus of plants of the natural family of Onagrariæ, but sometimes appended to the Halorageæ, sometimes formed into a distinct order, Hydrocaryes, water-nuts. Its name is abridged from Calcitrapa, the low Latin name of an instrument called caltrops, furnished with four spines, which was formerly employed to impede the progress of cavalry, but according to others the name is derived from τραπεω, 'to tread.' The fruit of Trapa is similarly furnished with spines, and the species are commonly called water-caltrops, from the plants floating on the surface of lakes, and on that of slow-running waters. They are found in the temperate parts of Europe and of Siberia, in Cashmere, India, Cochin-China, and China. The genus is characterised by having a 4-parted adherent calyx; petals and stamens 4; ovary 2-celled, with solitary pendulous ovules. The fruit is hard, indehiscent, 1-celled and 1-seeded. The seed is large and exalbuminous; the two cotyledons very unequal. The floating habit and clustered leaves easily distinguish these plants. The leaves under water are cut into capillary segments, and the petioles are tumid in the middle.

These small plants are of much more importance than many which are more conspicuous or better known, from the large seeds of all consisting of pure edible fecula. Trapa natans, the European species, is remarkable for its fruit with four spines, being of a blackish colour and large size, and its seed, which nearly fills it, being farinaceous, and good to eat, whether raw, roasted, or in soups, and is somewhat like a chestnut in taste. It was known to the antients by the name of Tribulus. Pliny says (lib. xxi., c. 58), 'About the rivers Nilus and Strymon the inhabitants gather it for their meat.' They used to be sold in Venice under the name of Jesuits' nuts, and are still to be found in the markets of the south of France and in Italy. They are supposed to have been esteemed by the Egyptians, as they are sometimes found within the folds of the mummy-cloth.

The Indian and Chinese species have each only two horns. The former is the *Trapa bispinosa* of Roxb. ('Corom. Pl.,' ii. 234), with the nut having two opposite, straight, barbed, spinous horns, noticed by Sir W. Jones under the Sanscrit name of Sringata: it is commonly known all over India by the name Singara, both names having reference to its horned appearance. It is also found in the lake of Cashmere. In India the nuts are sold in all the bazaars, as their farinaceous kernels are much esteemed by the Hindus. A species called by the same name, *Singhara*, forms a considerable portion of the food of the inhabitants of Cashmere, as we learn from Mr. Forster that in his time it yielded the government a revenue of about 12,000*l*. Mr. Moorcroft mentions a similar sum as Runjit Sing's share from the tax on 96,000 to 128,000 ass-loads of this nut yielded by the Wuller lake. So Mr. Vigne says, the Singara, or water-nut, is produced in such abundance on the lake, as to form a very considerable article of revenue. 'In the month of December I have seen many dozens of boats, and several men in each, collecting the sangara. The roots are loosened by means of ropes fastened between two boats, and iron prongs are used in collecting them.'

The Chinese species, or Trapa bicornis, is distinguished from T. bispinosa by its two horns being recurved and very obtuse. It is carefully cultivated in lakes, ponds, and other receptacles of water, and is named by the Chinese Lin-ko: it is distinct from their Pi-tsi, or Scirpus tuberosus, which is also called water-chestnut, and which is described by Grosier under the Chinese name.

TRAPANI, *Intendenza* or *Province of*, comprises the western extremity of Sicily, and is bounded on the north-east by the province of Palermo, and by that of Girgenti on the south-east, being separated from the latter by the river Belice, the antient Hypsa. The province is divided into three districts, Trapani, Mazzara, and Alcamo; and it includes several considerable towns besides Trapani:—1, Mazzara, a bishop's see, was an important town in the time of the Saracens, and was afterwards the residence of Count Roger, the Norman conqueror of Sicily: it is on the sea-coast, has 8000 inhabitants, several churches and convents, a castle, and some trade in agricultural produce. Mazzara gave its name to one of the three former valli or divisions of Sicily, Val di Mazzara, which included about two-fifths of the island. 2, MARSALA. 3, Castel Vetrano, about 12 miles east of Mazzara, inland, is an old-looking town, built on a hill, in a fertile country, producing good wine and abounding with cattle. It has several churches and convents, an old castle, and several palaces, among others that of the Monteleone family. Six miles south of Castel Vetrano is the site of the antient Selinus, on the sea-coast, with the ruins of several temples, consisting of extensive heaps of broken columns, capitals, and other fragments. Fragments of marble, alti-rilievi of curious workmanship, were discovered in 1822, among the ruins. [SICILY, *Antient History of*, at the end.] The style of these sculptures, which are known by the name of 'Selinuntine marbles,' is noticed under SCULPTURE. 4, About eight miles north of Castel Vetrano, on a hill, is Salemi, a town of 12,000 inhabitants, with a suburb called Rabat. 5, East of Salemi, in the mountains, is Gibellina, with a castle and 5000 inhabitants. 6, Farther north is Calatafimi, a town of 10,000 inhabitants, with several fine churches. The best cheese in Sicily is made in its territory. 7, Proceeding towards the northern coast of the island is ALCAMO. All this part of Sicily came earliest into possession of the Saracens, from whom most of the towns have derived their actual names. A few miles west of Alcamo, in the midst of a solitude, are the remains of Segesta, consisting of a fine Doric temple in good preservation, the ruins of a theatre, and part of the city walls. On the neighbouring sea-coast, where was formerly the port of Segesta, is the small town of Castellamare, with a fortress, and about 4000 inhabitants, who carry on some trade by sea, chiefly in corn. Castellamare gives its name to the deep gulf formerly called Sinus Segestanus. 8, Partanna, an inland town east of Castel Vetrano, has about 10,000 inhabitants. 9, Near Trapani is the town of San Giuliano, on Mount Eryx, with about 9000 inhabitants.

The islands of Favignana, Levanzo, and Maretimo, as well as the smaller group of the Ægades, and the small islands near Cape Lilybaeum, one of which is the antient Motya, an early Phœnician and Carthaginian colony, belong to the administrative province of Trapani. The whole population of the province by the census of 1831 consisted of 173,287 inhabitants.

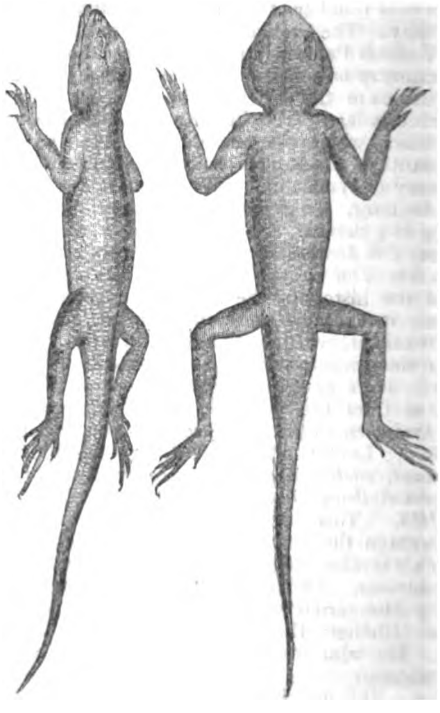
(Serristori, *Statistica dell' Italia;* Scasso Borrello, *Descrizione Geografica della Sicilia;* Paternò, *Viaggio per le Antichità della Sicilia;* Neigebaur, *Gemälde Italiens.*)

TRA'PANI, a town on the N.W. coast of Sicily, built on the site of the antient Drepanum, on a point of land projecting into the sea, and facing the island of Levanzo, which is ten miles west of it. [SICILY, 'Group of the Trapani islands.'] East of Trapani rises the Monte San Giuliano, the antient Eryx, where are remains of the famous temple of Venus Erycina, consisting of some broken columns and part of the substructure. It was on Mount Eryx that Hamilcar Barcas maintained himself for years against the Roman forces till the end of the first Punic war. There is a recent work on Mount Eryx by Sammartano e Salerno: 'Saggio storico, statistico, mineralogico, medico, botanico, sul Monte Erice, sua Città, e suoi d'Intorni,' 8vo., Palermo, 1826. Drepanum was a place of traffic from the oldest times on record, and its Greek name, 'Drepanon,' 'a scythe,' is expressive of the form of the promontory on which it stands. There are however no remains of antiquity at Trapani; but on an insulated rock which stands at the entrance of the harbour is a small fort called Columbara, consisting of an antient tower, which was restored in the early part of the 16th century, according to the testimony of Fazello, the historian of Sicily. The harbour of Trapani is formed by nature, being an inlet of the sea between the promontory and the mainland, protected on the west by the rock above mentioned, but open to the libeccio, or south-west wind, which is most dangerous on this coast. Trapani is one of the principal ports of Sicily, and carries on a considerable trade. One of the chief articles of export is salt, which is obtained by the evaporation of the sea-water in the extensive salterns, or salt-pans, along the coast. Another article of traffic is tunny fish, which is caught in May and June in various tonnare, or establishments for the purpose, on the coast north of Trapani and in the island of Favignana. The salt of Trapani is much esteemed, and is exported to Italy and to the ports in the Baltic. The tunny fish is pickled and sent to Naples and other parts of Italy. The coral fishery is another branch of trade. The boats from Trapani gather the coral along the neighbouring coast of Barbary, after which it is worked in the town, from whence it is exported to the Levant, to England, the East Indies, and other places. A great quantity of anchovies are also caught along the coast of Trapani in February, March, and April, salted down and exported. Sumach is also exported from Trapani. (De Welz, *Saggio sù i Mezzi di moltiplicare le Ricchezze della Sicilia.*) The seamen of Trapani are among the best in Sicily. Trapani has a collegiate church, numerous other churches and convents, among which those of the Jesuits and Carmelites are most worthy of notice; a handsome town-house with a fine façade and adorned with the statues of Philip V. of Spain and of Victor Amadeus of Savoy, both kings of Sicily; several palaces of the nobility, a royal college, an orphan asylum, several hospitals, a Monte di Pietà,' and about 12,000 inhabitants, according to Neigebaur and the Italian guide-books, though Balbi reckons its population at 24,000. The women of Trapani are remarked for their beauty and regular features. The town is enclosed by walls, and is defended by a fortress. The streets are wide and well paved with flag-stones.

(Scasso Borrello, *Descrizione Geografica dell' Isola di Sicilia;* Neigebaur.)

TRA'PELUS, Cuvier's name for a genus of Lizards which have the form and teeth of the *Agamæ* [AGAMA] but their scales are small and without spines. They have no pores on the thighs.

Example, *Trapelus Ægyptius.*



Trapelus Ægyptius. (Agama mutabilis, Merrem.)

This is a small reptile, which sometimes puffs out its body, whence the name of *orbicularis*, Daud. It is also remarkable for its changes of colour, which are executed nore promptly than those of the CHAMELEON; hence the French name of *Le Changeant d'Egypte*. Cuvier remarks hat the young animal is entirely smooth: the adult has ome rather greater scales scattered over the body among he others.

Mr. J. E. Gray places *Trapelus* in the family *Agamidæ*, etween *Agama* and *Stellio*.

TRAPE'ZIUM, TRAPEZOID. The first word (*τραπέ-ιον*, a little table) is used by Euclid for any four-sided igure which is not a parallelogram. The second word, ormed from the first, has been used by various writers, nd in different senses. A trapezoid, says Harris (*Lex. 'ech.*) is a solid irregular figure, having four sides not arallel to one another: Hutton repeats this, but says it ometimes means a trapezium, two (only) of whose sides re parallel to each other. What the *solid* figure with our *sides* means we do not know: but as the word is never sed, we omit all inquiry about it. Words however are so carce in mathematical language, that it is a pity when ny become obsolete. If we were to suggest meanings or these terms, we should propose that *trapezium* should e the general word for *plane* four-sided figures, parallelo-rams and all; and that *trapezoid* should denote a four-ided figure whose sides are not in the same plane. Per-aps this is what was intended by the *solid* figure of four ides: if so, it was particularly unnecessary to state that hese sides are not parallel.

TRAPEZUS. [TREBIZOND.]

TRAPP, JOSEPH, D.D., was born at Cherrington in loucestershire, in November, 1679. He was entered at adham College, Oxford, in 1695, took his degree of aster of Arts in 1702, and was chosen a Fellow of his col-ege in 1704. In 1708 he was appointed the first professor f poetry at Oxford, and at the expiration of his term of ffice published the lectures he had delivered on the sub-ect, under the title of 'Prælectiones Poeticæ,' in 3 vols. vo., 1718. Dr. Trapp was warmly attached to the Tory arty in the government, and took an active part in the olitical disputes of the time. He acted as manager for r. Sacheverell on his trial in 1710, and upon the Tories oming into power in the autumn of the same year he was ppointed chaplain to Sir Constantine Phipps, lord chan-ellor of Ireland. He was afterwards appointed chaplain Lord Bolingbroke, and wrote several papers in the Examiner' in defence of his administration. He obtained e living of Dauntzey in Wiltshire in 1720, but resigned in the following year upon obtaining the vicarage of the nited parishes of Christ Church, Newgate-Street, and St. eonard's, Forster-Lane, London. In 1733 he was pre-ented to the living of Harlington in Middlesex by Lord olingbroke, and in the following year was elected one of e joint lecturers of St. Martin's-in-the-Fields. He died ovember 22, 1747, at the age of sixty-eight, and was uried in Harlington church.

Dr. Trapp was a hard student, and published numerous orks, which acquired for him considerable reputation in is own day, but would now scarcely repay the trouble of eading. One of his best works is said to be 'Notes upon he Gospels,' first published in 1747. He published several ermons, which he preached upon various occasions, and lso numerous pamphlets against the Whigs, but these enerally appeared without his name. His translation of irgil into blank verse, published in 1717, in 2 vols. 4to., enerally succeeds in giving the meaning of the original, ut is a complete failure as a work of art. His Latin oetry is said to be better than his English; he published Latin translation of 'Anacreon' and of Milton's 'Para-ise Lost.'

(*Biographia Britannica*; Nichols's *Bowyer*; Chalmers's *Biographical Dictionary*.)

TRAPPE, LA, the abbey of, was founded in 1140 by Rotrou, comte du Perche. It is situated in the department of Orne, about three leagues north-east of Mortagne, and as many south-west of Aigle. The high road from Paris to Brest passes through the former town; the high road from Paris to Cherbourg through the latter; the vicinal path from Mortagne to Aigle passes at the distance of a few gun-shots from the monastery. And yet although so easily accessible from the busy world, the uncultivated lands, heaths, and dark forests by which the grounds cultivated by the brethren are surrounded, conspire even at the present day to produce the impression of a savage solitude. Of late years the ponds which abounded in the valley have been drained, and it is now healthy enough, but formerly it was the constant abode of sickness. La Trappe is the name which the valley has borne as long as it is known to have had a name; and it is supposed to have been bestowed on account of the difficulty of finding egress from it.

The monastery, founded by Rotrou II., adopted the rule of Citeaux, and became a filial establishment of Clairvaux. Its revenues were considerably enlarged in 1214 by donations made to it by Rotrou III. previous to his departure for the Holy Land. It continued to grow in reputation for the sanctity of its inmates, and in wealth, till towards the close of the fifteenth century. It was then, like many other abbeys, given to be held *in commendam*, and from that time its domains were neglected and mismanaged, and the discipline of the monks relaxed. About the middle of the seventeenth century they had acquired among the peasants the title of the brigands of La Trappe; and although this may not have been meant to imply that, like the Friar Tuck of English romance, they actually betook themselves to the highway, the seven brethren who yet retained the habit were stout topers, staunch hunters, and their abode was shunned by every man or maiden who was anxious to retain a fair character.

Affairs were in this state, when in the year 1636 the abbey was bestowed upon Armand Jean le Bouthillier de Rancy, then only in his tenth year. De Rancy, sprung from an antient and honourable family, was born at Paris on the 19th of January, 1626. Of an ardent temperament, he displayed at an early age a passion for letters. He is said at the age of twelve years to have published an edition of Anacreon, with notes, dedicated to Cardinal Richelieu. In his thirteenth year he published an essay on the dignity of the soul. The testimonials which he received at the close of his college career were more flattering than those given to his class-fellow Bossuet. Soon after taking the slender vows which bound an abbé, he was appointed almoner to Gaston, duke of Orleans. The warm temperament which had developed his precocious talents, the tastes indicated and confirmed by his study of Greek letters, prompted him to plunge deeply into the brilliant voluptuousness of the courtly circle to which this appointment introduced him, and in which his fortune enabled him to vie with the most luxurious. The Abbé de la Trappe was distinguished for his ardour in the chase, for the splendour of his house, for his delicate entertainments, and for his intrigues with the fair sex. In this career he is said to have been arrested by finding a lady (Madame de Montbazon), with whom he had an assignation, dead of a loathsome disease, on stealing into her apartment. The story is without sufficient evidence, and belongs to that class of melo-dramatic horrors which require the very strongest to render them credible. There needed no such startling adventure to inspire one who from his boyish years had rioted in sensual indulgence, and who possessed a prompt and energetic will, and a dash of imagination, with satiety in his thirty-fourth year. The morbid feeling that 'all is vanity,' which would naturally steal over such a one in such circumstances, might be heightened if not originated by a narrow escape he made in hunting, and by the death of his patron, the duke of Orleans.

Whatever the cause, soon after the death of the duke his late almoner spontaneously denuded himself of all his rich benefices, with the exception of La Trappe. In that monastery he attempted to re-establish its old discipline, but at first with little success. The 'brigands of La Trappe' struggled fiercely against the restraints they were invited to impose upon themselves: they threatened to throw their importunate superior into the fish-ponds; and Louis le Loureur, a brigadier then stationed at Mortagne, felt himself called upon to offer the protection of his soldiers to the abbé. De Rancy preferred the milder method, which turneth away wrath. He applied a part of his patrimony to pension off the recusant brethren. On the 17th of August, 1662, with the consent of the heads of the order, a *concordat* was arranged between the Abbé de Rancy and the old monks, in virtue of which they evacuated the premises, which were immediately taken possession of by the brethren of the Strict Observance. The concordat was ratified by the parliament of Paris on the 16th of February, 1663. The vows of an abbé made little difference between him who took them and the laity. De Rancy had yet to qualify himself for taking the active government of his new colony of devotees. In 1663 he commenced his noviciate in the abbey of Perseigne, which was subject to the rules of the Strict Observance: in 1664 he took all the vows, in company with an attached domestic who followed his master in his retreat from the world, and was confirmed abbot by Maurice Plunkett, titular bishop of Ardagh.

His zeal and eloquence soon prevailed upon his associates to adopt as much of the antient rigour of their order as he deemed possible in the altered circumstances of society. The community devoted themselves to the observance of strict silence, to hard labour, to total abstinence from wine, eggs, fish, and all seasoning of their simple diet of bread and vegetables. Excited by his representations, the monks wished to bind themselves at once by a vow; but their experienced and judicious superior refused to permit this until they had ascertained experimentally that the state of mind which prompted such mortification of the body was permanent. This anxious care to save his flock from the entanglement of rash vows was not the only occasion on which the Abbé de la Trappe showed that judgment held divided empire in his mind with imagination. His advice was in request at the councils of his order, and even at the worldly-minded court of Rome. Bossuet took pleasure in retiring to La Trappe and holding converse with its abbot. In 1686 De Rancy resigned his office of superior: he survived till the 27th of October, 1700.

The reputation which the abbey acquired under the author of the new reform continued undiminished till the Revolution. There were in all ten abbots under the reformed system:—

1. Armand Jean de Rancy, regular abbot from 1664 to 1686, when he resigned: died in 1700, aged seventy-four.
2. Zozime I. (his secular name was Pierre Foisil), born at Bellesme: held the office ten years, and died in 1696, aged thirty-five.
3. François Armand Gervaise, born at Paris: resigned his charge in 1698, after holding it two years: the year of his death is uncertain.
4. Jacques la Cour, born at Soissons: resigned in 1713, and died in 1720.
5. Isidore (his secular name was Maximilien Dannetière), born at Tournai: died in 1727, at the age of sixty-six.
6. François Augustin Gouche, born at Eu, died in 1734, at the age of fifty-two.
7. Zozime II. (Hurel), born in the French Vexin, died in 1747, at the age of seventy-seven.
8. Malachic Brun, died in 1766, at the age of seventy-seven.
9. Théodore Chambon, appears to have died at the close of 1783.
10. Pierre Olivier, was elected in January, 1784, and was at the head of the community when all religious orders were suppressed in France.

The Trappists having been involved in the common suppression of the religious orders, notwithstanding the petitions of all the neighbouring communes in their favour, only four or five availed themselves of the opportunity of returning to the world. The rest, under the guidance of Dom Augustin (his secular name was Lestrange), sought and found a refuge in a valley of the Swiss canton of Friburg, to which they gave the name of Val-Sainte. Here the brethren agreed to render still more strict the reform of the Abbé de la Trappe. These additional severities consisted in, 1, the abandonment of separate cells for each individual; 2, dispensing with mattresses; 3, shortening their time for sleeping by one hour; 4, restricting themselves to water for their drink; 5, increased strictness of their fasts; 6, three additional hours of labour every day; and, 7, the prolongation of their ceremonial devotions. When the French invaded Switzerland, the Trappists fled before them; but after shifting their place of residence for some years, they were allowed to return to Val-Sainte. Bonaparte showed, on his first accession to power, an inclination to patronise them. He even endowed a house of Trappists on Mont Genèvre with 30,000 franks per annum; and another at Corvara, near Genoa, with 10,000, but a dispute which he had in 1811 with the superior of Corvara led him to proscribe the whole order. After the restoration of the Bourbons, the Trappists were allowed to return to France. They contrived to purchase the site of their dilapidated monastery and some of the adjoining fields, but the extensive forests, in the innermost recesses of which they are situated, remain the property of the state. Complaints were raised against the Trappists by some of the French bishops, and Dom Augustin was obliged to repair to Rome to plead the cause of his order. He returned with success from his mission, but was attacked at Lyon by a complaint, which terminated fatally on the 18th of July, 1827. He left in tranquillity the order which his skill and courage had piloted through the storms of the Revolution. In addition to the parent establishment, a number of the Trappists settled at Aiguebelles, in the diocese of Valence: the brethren who had emigrated to America returned and settled at Bellefontaine in the diocese of Angers; and those who had found shelter in England established themselves at Melleray, in the diocese of Nantes. The original monastery of La Trappe is called, by way of distinction, La Grande Trappe du Perche. On the 30th of August, 1833, the new church and monastery were consecrated with great solemnity by the bishop of Séez. The monks enjoy much of the reputation of their predecessors; and their services as physicians and (notwithstanding their curtailed means) as almsgivers to the peasantry of the surrounding districts entitle them to the reputation.

(*Déscription de l'Abbaye de la Trappe*, Paris, 1670; *La Trappe mieux connue*, Paris, 1834.)

TRAS-OS-MONTES, a province of Portugal, so called from its being situated beyond the mountains of Xerez and el-Maraon, which separate it from the province of Entre Minho e Douro. It extends 22 Portuguese leagues from east to west, and 15 from north to south. It is divided into four districts, named Miranda, Bragança, Torre de Moncorvo, and Villa Real; and contains, besides the capital, 3 cities, 15 large 'villas' or towns, and 260 'fuegos' or fires. It is watered by the rivers Sabor, Tuela, Tameja, and many less considerable streams. The soil is generally barren and unproductive, with the exception of the valleys, which are highly cultivated, and yield abundant crops of oil, corn, and a large amount of wine.

TRASS. A deposit of volcanic ashes and scoriæ thrown out from the Eifel volcanoes, and accumulated in valleys and old lakes under the influence of water is thus designated. It is equivalent, or nearly so, to the puzzolana of the Neapolitans. (Lyell's *Principles of Geology*

TRASYMENIAN LAKE. [PERUGIA, DELEGAZIONE DI.]

TRAU is the chief town of a district of the same name in the circle of Spalatro, in the Austrian kingdom of Dalmatia, the area of which is 240 square miles, and the population (in 1832) 17,054 Roman Catholics, and 427 non united Greeks. Trau is built on a small island, which is connected with the continent by a wooden bridge fifty paces in length. On the other side there is a channel 350 feet broad between it and the island of Bua, with which it is connected by a mole, with a drawbridge to allow ships to pass, the numerous coasting vessels preferring this channel to the open sea. Trau is an old ill-built town, with narrow crooked streets. Seven small hills rise above the town. It has a handsome Gothic cathedral, several other churches, three convents, and an hospital. The antient citadel and fortifications are now in ruins. A bishop and chapter, under the archbishop of Spalatro, reside here. There is a small pretty good harbour, which is now not much frequented. The inhabitants, about 3000 in number, have a pretty considerable trade in the produce of the country,—wine, olives, figs, almonds, and other fruits. The island of Bua, which is five leagues in length, produces the above fruit in great abundance. (*Die Oesterreichische Monarchie*, anonymous; Blumenbach, *Gemälde der Oesterreichischen Monarchie*; Stein, *Geog. Lexicon.*

TRAVANCORE. [HINDUSTAN, p. 204.]

TRAVELLER'S-JOY. [CLEMATIS.]

TRAVEMÜNDE, a small seaport of the Baltic, in the territory of the free Hanseatic city of Lübeck, is situated in 53° 58′ N. lat. and 10° 50′ E. long., at the mouth of the river Trave (as its name imports), about ten miles from Lübeck and forty-two from Hamburg. The river Trave is 650 feet broad, and has sufficient depth of water for the largest merchantmen. The town lies on the north-west bank of the river, and has a wall and moat on the land side. There are about 1200 inhabitants, who are for the most part fishermen and pilots. No pains or expense are spared to make the harbour secure and convenient. A lighthouse, 120 feet high, which is visible at the distance of 35 miles, stands on a sand-bank near the coast of the Baltic. Travemünde is much frequented in the summer for the benefit of sea-bathing. The importance of this small town has been much increased within a few years by the establishment of steamboats between it and St. Petersburg. By this means the mails from Russia, which used to come all the way by land, and were a fortnight or longer on the way, now arrive at Lübeck in three days and a half or four days, and reach England by way of Hamburg in a week, instead of eighteen days or more.

(Zeitz, *Ansichten von Lübeck;* Stein, *Lexicon;* Von Schlieben, *Die Deutschen Bundesstaaten.*)

TRAVERS, LAKE. [MISSISSIPPI RIVER.]

TRAVERSA'RI, AMBRO'GIO, called also Ambrosius Camaldulensis, a great scholar and public character of the fifteenth century, was born in the village of Patico near Forlì, in 1386. Some assert that his family was a branch of the Traversari who once ruled over Ravenna. At fourteen years of age Ambrogio entered the order of the Camaldulenses at Florence. He is said to have studied Greek under Chrysoloras, and afterwards under Demetrius Scarani of Constantinople, who became a Camaldulensian monk at Florence about 1417. Traversari became a good Greek and Latin scholar, and applied himself entirely to classical studies till 1431, when he was made general of his order. He was intimate with Cosmo de' Medici, Niccolo Niccoli, Francesco Barbaro, Leonardo Giustiniani, and other learned men and patrons of learning of that age. When Cosmo and his brother Lorenzo the elder were in banishment at Venice, in 1433, Traversari, who was in that town, often visited them, and he speaks of them in his letters with esteem and affection. He instructed several pupils, and among others Giannozzo Manetti, who became a distinguished scholar. Traversari travelled much for the affairs of his order, and he collected in his travels materials for his 'Hodaeporicon,' which is a description of what he had seen, containing many particulars concerning the literary history of that time, and the various libraries then existing in Italy. The 'Hodaeporicon' was first edited at Lucca by Bartolini, in 1681. He also collected valuable MSS. which helped Cosmo to form the public library in the convent of St. Marco, together with the collection of Niccolo Niccoli and those of Peruzzi and Salutati. In 1435 Pope Eugenius IV. sent Traversari to the stormy council of Basle, where he exerted himself with much ability in favour of Eugenius, and was instrumental in winning over to the pope's party the learned Cardinal Cesarini, the president of the council, who suddenly left Basle and repaired to Ferrara, whither the pope had transferred the council in January, 1438. Traversari was sent from Basle into Germany on a mission from the pope to the emperor Sigismund, and on returning to Italy he was deputed to Venice to receive the emperor Palæologus and the patriarch of Constantinople, and to conduct them to Ferrara, from whence the council was soon after removed to Florence. Traversari acted in that assembly as interpreter between the Greeks and the Latins, and he had the satisfaction of seeing the reunion of the two churches. He soon after died at Florence, in October, 1439. He left Latin translations of many Greek works, especially of ecclesiastical writers, such as Chrysostom, Basilius, Athanasius, Ephrem Syrus, Johannes Climachus, and others, of which, as well as of other inedited works of Traversari, his biographers Mehus, Cateni, Ginanni, and Zeno have given catalogues. His translation of the Lives of Diogenes Laertius, dedicated by him to his friend Cosmo de' Medici, was printed at Venice in 1475. Some of his Orations delivered in the council of Basle are also printed. His numerous letters were collected by Father Canneti, and published, with the addition of learned notes and a biography of Traversari, by Lorenzo Mehus: 'Traversarii Ambrosii Epistolæ Latinæ et aliorum ad ipsum, curante P. Canneto, cum Ambrosii Vita, studio L. Mehus,' 2 vols. fol., Florence, 1759, an important work for the literary history of Italy during the fourteenth and fifteenth centuries.

(Tiraboschi, *Storia della Letteratura Italiana;* Lombardi, continuation of Tiraboschi.)

TRAVERSE, in Law, is a contradiction of some matter of fact alleged in pleading by the opposite party. It ought to be by express words and not argumentatively. Generally all matter of fact, that is material, ought to be either confessed and avoided, or traversed; and if a party justifies an act as to one particular time and place, or confesses and avoids in one respect, he ought to traverse it as to all other. Otherwise what is materially alleged will be taken to be admitted. But matter of law when not connected with fact ought not to be traversed, nor should matter of record, nor matter which is not triable: for the object of a traverse is to raise an issue for the decision of a jury.

Traverse of an immaterial fact, or of a mere supposition, or of inducement, is bad, for it is not an answer to the action. For the same reason, a traverse which is too large is bad, as where, in an action for stopping three lights, the defendant traverses the stopping of all three, for the action would lie although he stopped only one. It is also bad if it is too narrow, as if an action is brought for an act alleged to be done in one county, and the defendant justifies under process by the sheriff in another county, and traverses the act in the place alleged only, for he ought to traverse as to all counties except that to which the process went. If a traverse is tendered as to a material point by one party, the other must accept it; he cannot waive it and tender another traverse. (Com. *Dig.*, tit. 'Pleader,' Geo. I., &c.)

In criminal pleading traverse of an indictment is the taking issue and denying some material point in it. Not guilty is a general traverse, which throws on the prosecutor the necessity of proving all the material facts.

By the common law, the defendant in a case of misdemeanour might, by traversing the indictment, postpone the trial to the next sessions or assizes; but now, in all cases except those for the non-repair of bridges or highways, he must, if he has been in custody or on bail twenty days on the same charge, plead and be tried immediately. (1 Geo. IV., c. 4.)

TRAVERSE TABLE, a table used in navigation, in what is called traverse sailing, which is merely the sailing on different points of the compass, for short distances, in succession. This table is useful for many other purposes, being a small and handy trigonometrical canon, as follows:—The angle a ship makes with the meridian is the angle of the course; the distance run in that course is the hypothenuse of a right-angled triangle, and the side opposite to the angle of the course is called the *departure* (from the meridian). The side adjacent to the angle of the course is called the *difference of latitude* (this being found from it by reducing miles or leagues to degrees). The traverse table is a table of double entry, into which, going with the angle of the course and the distance run, we find in two columns the corresponding departure, and length of the side called difference of latitude. Thus, in Garrard's Tables, London, 1789, which are among the largest of traverse tables, we find all units of distance run, from 1 to 300, with every angle of the course which is a multiple of 10′. For instance, at a course of 24° 40′ with the meridian, and a distance run of 259 miles, we find 108·09 miles for the departure, and 235·37 miles for the side called difference of latitude: meaning that a right-angled triangle with an hypothenuse of 259, and one of the angles 24° 40′, has the side opposite to that angle 108·09, and the side adjacent 235·37. Such a table as this is overlooked by many who might use it with profit, simply because it seems only a technical table of navigation. Sometimes it is made only to quarter points of the compass for the angles, with various limits of distance.

TRAVERSES, in Fortification, are usually masses of earth which are raised at intervals across the terreplein of a rampart or across the covered-way of a fortress: their positions in the covered-way are indicated at *t*, *t*, &c. [FORTIFICATION, p. 377.] On a rampart they serve to protect the guns and men against the effects of a ricocheting or enfilading fire, which might otherwise dismount the former, and compel the latter to abandon the parapet; and in the covered-way, besides serving for similar purposes, they constitute retrenchments behind which the defenders may keep up an annoying fire of musketry upon the enemy, should the latter attempt to force his way along the branches of that work. On this account they are provided with banquettes, or steps, on which the defenders may stand to fire over them. Such a work, when formed in a direction parallel to a rampart or parapet, on its interior side, for the purpose of securing the defenders against a fire from the ground in their rear, is called a parados.

Palisades are planted along the banquettes, in order to prevent the assailants from suddenly passing over the traverses; and, at the passage between each traverse and the interior side of the glacis, is a strong gate, or barrier, which is closed in the event of the defenders being obliged to retire from one traverse to the next, or to abandon the covered-way entirely.

As, at the time of an assault being made at the salient part of a covered-way, the defenders might be bayoneted in attempting to retire along the passages between the traverses and the glacis (those passages being then commanded by the enemy), it has been recommended to form other passages about four feet wide between the opposite extremities of the traverses and the top of the counterscarp; and, in order that the retreat may be effected without molestation, a line of palisades is planted from each traverse to the next along the middle of the covered-way, in addition to the line which is always planted along the foot of the interior slope of the glacis.

The traverses, like other parapets, are usually above eighteen feet thick at the upper part, in order that they may not be immediately destroyed by the heavy artillery of the enemy: but the French engineers recommend that all the traverses in the covered-way, except those which are close to the re-entering places of arms L, L [FORTIFICATION], should not exceed twelve feet in thickness, as it may be advantageous for the defenders to destroy them in the event of the enemy endeavouring to protect himself by them during the operation of cutting a trench across the covered-way for the purpose of making a descent into the ditch of the fortress.

Since, on the covered-way being attacked by main force, the traverses are frequently abandoned without resistance, Bousmard proposes that they should be made in the form of redans, and have, in the thickness of the parapet of each face, a small gallery with loop-holes, through which, as well as over the top of the traverse, a fire of musketry may be directed into the covered-way. The traverses are to be protected by fraizes planted on the exterior slopes; and it is supposed that the fire from the two tiers of muskets will entirely prevent the success of an attack which is not carried on by the regular process of sapping. The gallery in the traverse is to communicate with the magistral gallery of the countermines, so that the defenders, if at last compelled to retire within the enceinte, may pass through the latter gallery, and through that which is formed in the caponniere, without being observed by the enemy.

TRAVERTIN, the Italian term for concretionary limestone produced from springs holding carbonate of lime in solution. It is not exactly equivalent to the term '*tufa*,' which expresses the loose and porous surface deposit from calcareous springs, while *travertin* applies to the more solid limestone, less frequently formed in lakes and on hill sides. Waters charged with carbonate of lime abound in many countries, and the production of tufa is an extremely common phenomenon; but the accumulation of travertin in great quantity appears to be often associated with centres and lines of antient volcanic excitement, or with great natural fissures of the strata. A large proportion of the most splendid edifices of antient and modern Rome are built of travertin derived from the quarries of Ponte Leucano. Lyell, 'Principles of Geology,' book ii., chap. iii., may be consulted for a large and interesting collection of facts relating to the accumulation of these calcareous deposits.

TRAVESTY. [BURLESQUE; PARODY.]

TREACLE. [MOLASSES.]

TREAD-WHEEL. [TRANSPORTATION.]

TREASON. This term, in its legal signification, is derived from the French *trahison;* and in conformity with this derivation, the offences designated by it in English law always contained the notion of treachery, or a breach of that allegiance supposed to be due from an inferior to a superior. Thus petit-treason was the murder of a husband by his wife, or a master by his servant, or a bishop by his subordinate in the church; and high treason consists in an attack upon the king as the political head of the state. The former of these two kinds of treason was placed in another class of crimes by the statute of 9 Geo. IV., c. 31, s. 2, which enacts that 'every offence, which, before that act, would have amounted to petit-treason, should be deemed to be murder only, and no greater offence.' The only crime therefore now known to the law of England under this term is high treason, which, as it is composed of numerous acts and circumstances, constructively and remotely, as well as immediately, affecting the safety of the king's person, cannot be accurately described by any simple definition.

In early periods of the history of England, the law upon this subject was extremely vague and uncertain, in consequence of the great variety of acts which were held to constitute high treason as tending to diminish the power or dignity of the crown. In the times now alluded to, killing the king's father or brother, or even his messenger, refusing to answer in the king's courts, and summoning an English subject to appear and defend himself in the court of a foreign prince, were deemed to be acts of treason. (3 *Inst.* 7; Hawkins's *Pleas of the Crown*, b. 1., c. 17.) Indeed, immediately before the date of the statute of treasons, a knight was indicted for high treason in 'usurping royal power within the king's realm,' by assaulting another on the highway, taking his horse and detaining him until he paid 90*l*. (Hale's *Pleas of the Crown*, vol. i., p. 80.) From these and many other instances which are to be found in law books, it appears that almost every act that could be in any way considered as a breach of the allegiance due to the king, or a constructive assumption of royal authority, was deemed to be high treason, as an 'accroachment of royal power.' This arbitrary state of the law became the cause of intolerable oppressions, and a petition to Edward III. from a parliament, which Mr. Hallam calls 'one of the best that ever sat' (*Constitutional History*, vol. iii., p. 204), occasioned the statute 25 Edward III., commonly called the 'Statute of Treasons.' This enactment gave for the first time an intelligible definition of the crime of treason, and, notwithstanding the total change of national habits, still continues, after the lapse of five centuries, to be the governing law on the subject. Valuable as this law undoubtedly was in the comparatively rude times in which it was made, the inadequacy of its provisions to meet the complicated relations of a more refined state of society has frequently rendered supplemental statutes necessary, and has been the cause of those subtle and forced interpretations of its simple language, which have introduced scarcely less uncertainty and injustice into this department of the criminal law than prevailed before its enactment.

The several acts and circumstances constituting high treason by the 'Statute of Treasons' are as follows:—1, Compassing or imagining the death of the king, the queen consort, or their eldest son and heir. 2, Violating the king's companion (by which is meant the queen consort), or the king's eldest daughter unmarried, or the wife of the king's eldest son and heir. 3, Levying war against the king within his realm. 4, Being adherent to the king's enemies in his realm, giving them aid and comfort in the realm or elsewhere. 5, Counterfeiting the king's great or privy seal. 6, Counterfeiting the king's money, or knowingly bringing false money into the realm counterfeit to the money of England, to merchandize and make payment withal in deceit of the king and his people. 7, Slaying the chancellor, treasurer, or the king's justices of either bench, justices in eyre, justices of assize, or any other justices assigned to hear and determine, being in their places doing their offices. As several of the offences above enumerated are acts of the mind, and consist in intention, the statute declares that in such cases the intention, in order to come within the meaning of the law, must be manifested by some open or *overt* act done towards the accomplishment of the traitorous intention. This provision, although by its position in the statute it is apparently limited to the offence of adhering to the king's enemies, has been held to apply to all the treasons before mentioned. (Hale's *Pleas of the Crown*, vol. i., p. 108.)

The word 'king,' used in the first clause of the statute describing the offence of compassing the king's death, comprehends the case of a queen regnant, as she is invested by the constitution with full royal authority, and is entitled to the allegiance of her subjects. But the husband of the queen regnant is not within the words or meaning of the statute. The precise meaning of the words 'compass' and 'imagine' in this clause of the statute has been the subject of some discussion. Mr. Luders has thrown much light upon their signification by collecting the instances in which the same language has been used in writings contemporaneous with the statute; and although attempts have been made to give them a more enlarged signification, it is clear that they mean nothing more than 'attempt' and 'contrive.' (*Considerations on the Law of High Treason in the article of Levying War*, p. 137.) If this be so, the meaning of this clause is sufficiently obvious to an ordinary reader, and would be certainly limited in his apprehension to attempts or contrivances against the natural life of the king. But by means of legal construction, the words have received a much wider meaning. Thus, a conspiracy to imprison or depose the king, which by the statute of treasons is not declared to be a substantive treason, has been repeatedly held to be high treason in the article of compassing his death, because, according to a saying of Machiavelli, 'There is but a short interval between the prisons and graves of princes.' Mr. Hallam justly observes, that 'it seems not very reasonable to found a capital conviction on this sententious remark.' It appears indeed formerly to have been questionable law, for Chief Justice Brooke, who compiled his 'Abridgement of the Law' at the commencement of the sixteenth century, expresses a doubt whether a design to depose the king be within this clause of the statute; 'for,' says he, 'one may deprive the king of his crown, without designing his death;' and in confirmation of his view of the matter, he refers to the statutes which had been passed from time to time to remedy this defect in the Statute of Treasons. (Brooke's *Abridgement*, tit. 'Treason,' fol., 24.) And in fact experience shows that the adoption of this proposition would frequently lead to a false result, several instances of rebellion having occurred in English history, in which the designs of the rebels would have been wholly defeated by the death of the king, whose name they designed to employ. (*Constitutional History*, vol. iii., p. 208.) Nevertheless the doctrine that a design to depose is an overt act of compassing the death of the king has been repeatedly confirmed by treatises of the highest authority, as well as by judicial decisions. (Foster's *Discourse on High Treason*, p. 196; Howell's *State Trials*, vol. xxiv., p. 1361; vol. xxv., p. 725.) A still more extensive signification has been given to these words of the statute by the forced interpretation that a conspiracy to levy war against the king and also consulting with a foreign enemy to invade the realm, were overt acts of treason in the article of compassing the king's death. (Hale's *Pleas of the Crown*, vol. i., p. 120.) This mode of reading the plain words of a penal statute was obviously liable to serious objections and led to great oppression and injustice; 'such a method,' as Sir M. Hale says, 'admitting of no limits or bounds, but running as far as the wit or invention of accusers, and the odiousness and detestation of persons accused, will carry men.' (*Pleas of the Crown*, vol. i., p. 86-7.) 'Better,' says Lord Strafford, on his trial, 'it were to live under no law at all, and by the maxims of cautious prudence to conform ourselves the best we can to the arbitrary will of a master, than fancy we have a law on which we can rely, and find at last that this law shall inflict a punishment precedent to the promulgation, and try us by maxims unheard of till the very moment of the prosecution.'

The doctrine of constructive treason having been brought into prominent notice and much discussed in the trials of Hardy, Horne Tooke, and others in 1794, the statute 36 Geo. III., c. 7, was passed with a view of superseding the necessity of resorting to any such modes of interpretation for the future. This statute, which, although originally in force only for the life of George III., was made perpetual by the stat. 57 Geo. III., c. 6, enacted that 'if any person shall, within the realm or without, compass, imagine, invent, devise, or intend death or destruction, or any bodily harm tending to death or destruction, maim or wounding, imprisonment, or restraint of the person of the king, or to deprive or depose him from the style, honour, or kingly name of the imperial crown of this realm, or of any other of his majesty's dominions or countries, or to levy war against his majesty within this realm, in order by force or constraint to compel him to change his measures or councils, or in order to put any force or constraint upon, or to intimidate or overawe both Houses or either House of Parliament, or to move or stir any foreigner or stranger with force to invade this realm, or any other his majesty's dominions or countries under the obeisance of his majesty; and such compassings, imaginations, inventions, devices, and intentions, or any of them, shall express, utter, or declare, by publishing any printing or writing, or by any overt act or deed, every such offender, being legally convicted upon the oath of two lawful and credible witnesses, shall be adjudged a traitor, and suffer as in cases of high treason.' It was no doubt the intention of the legislature that this statute should put an end to all artificial constructions of the statute of Edward III.; nevertheless the practice of resorting to these forced interpretations has been continued, and sanctioned by the approbation of the judges in several subsequent prosecutions for high treason. (*Sixth Report of Commissioners on Criminal Law*, p. 16.)

The second kind of treason declared in the Statute of Treasons is the violation of females of the royal family, and was obviously intended to preserve the purity of the succession to the throne. With a view to this object, the law has been held to apply to a criminal connection by consent as well as to a forcible violation. It is worthy of remark, as one of the numerous circumstances showing the inapplicability of this antient law to modern times, that a queen regnant, whether married or single, is not within this clause of the statute.

The third species of treason above mentioned is 'levying war against the king in his realm.' It amounts to treason under this clause of the statute to take arms against the king, not only with the object of destroying him, but where it is intended by open violence to reform religion or the laws, or to remove evil counsellors, or other grievances, whether real or pretended. (Hawkins's *Pleas of the Crown*, b. i., c. xvii., s. 25.) The plain words of this clause of the statute have been still more extravagantly extended by legal construction than those of the clause relating to compassing the king's death. Thus riotous assemblies, where the object has been to destroy *all* property of any particular class, such as to pull down all meeting-houses, or to destroy all inclosures, have been held to be treason in all who join them, by reason of the generality of the design. This doctrine has however been much questioned in recent times; and to the extent formerly contended for, would probably not be countenanced by the judges at the present day. (Luders, *On Constructive Treasons; Sixth Report of Commissioners on Criminal Law.*) Indeed the necessity for constructive extensions of the words of this clause, which might have been plausibly argued from the omission in the statute of treasons to notice conspiracies or preparations to levy war against the king, has been entirely removed by the above-mentioned statute of the 36 Geo. III., c. 7.

The fourth kind of treason mentioned in the Statute of Treasons is adherence to the king's enemies. The enemies here mentioned are foreign powers and states with whom the king of England is at war, and who owe him no allegiance; and therefore an adherence to British subjects in a state of rebellion against the king will not constitute treason under this clause, although it may amount to treason in the article of levying war. This kind of treason must, like compassing the king's death, or levying war against him, be evidenced by some overt act, such as treacherously surrendering a fortified place, or supplying arms, or giving information to an enemy.

The fifth treason mentioned in the statute is counterfeiting the king's seals; which offence was continued as a capital treason by the Forgery Consolidation Act, 11 Geo. IV. and 1 Will. IV., c. 66. The punishment of death being however repealed in all cases of forgery excepting the forgery of wills and powers of attorney, by the stat. 2 & 3 Will. IV., c. 123, the offence of counterfeiting the royal seals appears now to be in the anomalous condition of being in quality a treason, but subject to no higher degree of punishment than transportation for life.

The clause in the Statute of Treasons which declares the offence of counterfeiting the king's coin to be high treason has been recently repealed by the stat. 2 Will. IV., c. 34; and the crime itself has been by the same enactment divided into distinct classes as felonies and misdemeanours, with a graduated scale of punishments.

The last species of treason above mentioned is the offence of slaying the chancellor or the judges, which still continues to be high treason. This part of the law is however obviously imperfect, as it does not comprehend the barons of the exchequer, who at the present day are the king's superior justices as fully as the judges of the other courts of Westminster Hall; whereas it includes the justices in eyre, whose office has long since been abolished.

Besides the several treasons above enumerated, a large class of offences has been created by various statutes passed from time to time in the reigns of Elizabeth and James I., with the avowed object of protecting the Protestant religion from the designs of Roman Catholics. But as many of these statutes have not been the subject of prosecution for nearly three centuries, and many others have never been enforced at all, they may perhaps be considered as virtually obsolete, and do not require to be particularly noticed in this article. (*Sixth Report of Commissioners on Criminal Law*, p. 35.)

With a view to diminish the peculiar disadvantage under which a person charged with treason was supposed to labour in having to defend himself against a prosecution in which so powerful an adversary as the crown was interested, several privileges as to process, evidence, and trial have been given by statute to persons so accused. It is declared by the stat. 7 Will. III., c. iii., s. 2, that no person whatsoever shall be indicted, tried, or attainted of high treason or of misprision of treason, but upon the oaths of two lawful witnesses, unless the party indicted shall willingly, without violence, in open court confess the same. And by the third section of the same statute, it is declared that if two or more distinct treasons of divers heads or kinds shall be alleged in one indictment, one witness produced to prove one of the treasons, and another witness to another of the treasons, shall not be deemed to be two witnesses to the same treason within the meaning of the statute. The same statute of the 7 Will. III., c. 3, also enacted that no person should be tried for any treason (except an attempt to assassinate the king) unless the indictment be found within three years after the offence committed. Moreover the prisoner is to be furnished with a copy of the indictment five days, and a copy of the panel of jurors two days, before the trial. He is to have the same compulsory process to enforce the attendance of his witnesses as was at the time of the statute exclusively applicable to the prosecutor's witnesses; and he is to have full defence by counsel selected by himself and expressly assigned to him by the court. The stat. 7 Anne, c. 21, materially extended these privileges by directing that all persons indicted for high treason, or misprision thereof, shall have not only a copy of the indictment, but also a list of all the witnesses to be produced, and of the jurors impanelled, with their professions and places of abode respectively, delivered to him ten days before the trial, and in the presence of two witnesses, the better to prepare him to make his challenges and defence.

It may perhaps be doubted whether these indulgences are founded upon any true principles of criminal jurisprudence. If justice requires them, they should be generally applied to all crimes; and at all events there seems to be no sufficient reason for giving a different measure of advantage to persons accused of high treason from that afforded to persons accused of many other offences. So obvious indeed was the inconsistency of giving greater privileges and advantages to a person charged with an attempt to kill the king than were permitted in the case of a similar attempt upon the life of a private person, that upon occasion of an attack upon George III., in the year 1800, an act of parliament was passed to remove it. The statute 39 & 40 Geo. III., c. 93, enacts that in all cases of high treason, in compassing or imagining the death of the king, and misprision of such treason, where the overt act alleged shall be the assassination or killing of the king, or any direct attempt against his life, or against his person, whereby his life may be endangered, or his person suffer bodily harm, the offender may be indicted, arraigned, tried, and attainted, in the same manner, and according to the same course and order of trial in every respect, and upon the like evidence, as if such person stood charged with murder; and none of the provisions contained in the above-mentioned acts of 7 Will. III., c. 3, and 7 Anne, c. 21, shall extend to any indictment for this species of treason. A clause in a subsequent statute (6 Geo. IV., c. 50, sect. 21) provides that the list of the jury shall in all indictments for treason, or misprision of treason, in other courts than the King's Bench, be delivered at the same time with the copy of the indictment, and ten days *before* the arraignment; and in the court of King's Bench it may be delivered *after* the arraignment, but ten days before the trial. This statute does not extend to the cases of attempts upon the life of the king mentioned in the stat. 39 & 40 Geo. III., c. 93. By the stat. 5 & 6 Vict., c. 51, the provisions of the stat. 39 & 40 Geo. III., c. 93, are extended to 'all cases of high treason in compassing or imagining the death or destruction of the queen, or in compassing or imagining any bodily harm tending to the death or destruction, maiming, or wounding of the queen, and of misprision of such treason, when the overt act alleged shall be any attempt to injure in any manner whatsoever the person of the queen;' and such cases are expressly excepted from the operation of the above-mentioned statutes of 7 Will. III., c. 3; 7 Anne, c. 21; and 6 George IV., c. 50, s. 21.

The judgment in high treason is that the offender shall be drawn on a hurdle to the place of execution, and there be hanged by the neck until he is dead; that afterwards his head shall be severed from his body; and his body, being divided into four quarters, shall be at the disposal of the crown. This punishment was substituted by a recent statute (54 Geo. III., c. 146) for the antient and barbarous sentence which required that the person convicted should be hanged, but taken down alive, and then that his bowels should be taken out and burnt before his face. By the 2nd section of stat. 54 Geo. III., c. 146, authority is given to the crown by warrant under the sign manual, countersigned by a secretary of state, to alter this sentence, and to direct that, instead of the ignominious part of it, the party shall be beheaded whilst alive.

TREASURE-TROVE, in legal Latin called *thesaurus inventus*, is a branch of the revenue of the crown by the law of England. Where coin, plate, or precious metals are found hidden in the earth or any private place, and the owner or person who deposited them is unknown, the property becomes vested in the king by virtue of his prerogative. But if the owner is known, or is ascertained after the treasure is found, the property belongs to him and not to the king. The civil law gave treasure found in general to the finder; but if found accidentally in another man's land, half was given to the finder, and half to the owner of the land. And so if it was found in the land of the emperor, it was to be equally divided between him and the finder. (*Inst.*, lib. ii., tit. i., § 39; *Cod.*, lib. x., tit. 15.) Grotius says that the title of the prince to treasure-trove had in modern times been so generally established in Europe as to have become 'jus commune et quasi gentium' (*De Jure Belli et Pacis*, lib. ii., c. viii., § 7). The law of England adopts the definition of treasure-trove from the civilians as 'vetus depositio pecuniæ cujus dominus ignoratur' (Paulus, lib. xxxi., § 1); and to entitle the crown to the property, it must appear to have been hidden or deposited by some one who at the time had the intention of reclaiming it. Whenever therefore the intention to abandon appears from the circumstances—as for instance, where the property has been found in the sea, or in a pond or river, or even openly placed upon the surface of the earth—it belongs to the finder. In England the concealment of treasure-trove from the king was formerly a capital offence; at the present day it is a misdemeanour punishable by fine and imprisonment. (Blackstone's *Commentaries*, vol. i., p. 295.)

TREASURY, a department of government which has control over the management, collection, and expenditure of the public revenue. It is the business of another department, the Exchequer, to take care that no issues of public money are made by the Treasury without their being in conformity with the authority specially enacted by parliament. When money is to be paid on account of the public service, this is almost always done on the authority of a Treasury warrant; and in other cases the countersign of the Treasury is requisite. The Board of Treasury consists of the prime minister and the chancellor of the exchequer. The real office which the Premier holds is generally that of first lord of the Treasury. There are also four junior lords, who have usually seats in parliament, as have also the two joint secretaries of the Treasury. The departments immediately subordinate to the Treasury are the boards of customs, of excise, of stamps and taxes, and the post-office, the various officers in which are to a great extent appointed by the lords of the Treasury; and this constitutes an important part of the patronage of the ministry. The control of the Treasury over the different boards of revenue and other departments is said to be much less complete now than it was fifty years ago. Constitutionally, its authority ought to be paramount. The duties of the board of Treasury are heavy and multifarious, all exceptional cases in matters relating to the revenue being referred to it. Previous to 1839 the annual parliamentary grant for education was dispensed by the Treasury; but from this business, to which it certainly could not pay sufficient attention, it was relieved by the appointment of the committee of Privy Council on Education. The expense of the Treasury, which has its offices in Whitehall, exceeds 80,000*l*. a year. Fifteen clerks receive salaries averaging 1000*l*. a year each; and of this number five receive 1500*l*. a year each. (Lord Congleton's *Financial Reform*.)

TREATY (immediately from the French *traité*) means literally that which has been drawn up, or, in other words, arranged and agreed upon, by two or more parties, who are accordingly called the contracting parties. It is in fact the same word with contract. The term in its several variations is now employed by most of the nations of Europe—by the Italians, the Spaniards, the Germans, the Dutch, &c., as well as by the English and the French—to designate the conventions or agreements which governments make with one another. By the Romans a treaty was commonly called *foedus*, a word of unknown or uncertain etymology. From *foedus* we have formed our federation, confederacy, &c.

Although a treaty is commonly defined to be an agreement made with one another by two or more governments, it is not necessary that the party to a treaty should always be an absolutely sovereign and independent power or political society. Communities, or even individuals, which are subjects in many or in all other respects, may be empowered to enter into treaties. Thus our English East India Company enjoys the right, and has repeatedly exercised it, of making treaties under certain limitations. But in all such cases this right must be given or allowed by the supreme authority in the state to which the contracting party belongs, or, which is the same thing, by the constitution or political system of which it is a member. So that treaties can only be made by sovereign powers, or by parties upon whom the sovereign power has conferred that right. In our constitution, for example, where the sovereign power consists of the king and the parliament, it has delegated the power of concluding treaties with foreign powers generally to the king. And this is the all-important fact for foreign countries or other powers to look to in negotiating and entering into conventions with the English nation: the only party with whom they have to do in such matters is the king, or the ministers whom he may have delegated to act for him and in his name.

It is usual, of course, for the crown, in this as in other cases, to act through its representatives; and the question has arisen in how far the principals to a treaty are to be held bound by the agreements entered into by the regularly authorised negotiators. The difficulty is this. The instructions given to the actual negotiator by his principal, as to what he shall accept or concede, are necessarily secret, at least in part, for obvious reasons: it is impossible therefore to know whether on any particular point he has exceeded his authority or not; and it would be always in the power of a government to allege that he had done so, if for any reason it desired to escape from the engagements he may have made in its name. If such a plea were well founded, it would seem to be a reasonable one; and it could hardly be proved not to be founded in fact, in any case in which it was urged. It would appear therefore to be either useless or unfair to hold the negotiator's signature to be the real conclusion of the treaty; useless, if the plea that he had exceeded his powers were to be allowed to be afterwards urged in abatement of the stipulations he had made; unfair, if such plea were not to be permitted. Accordingly, notwithstanding some writers on the law of nations (De Martens for example) have contended that a treaty is, strictly speaking, valid and binding from the moment of its being signed, that is not the doctrine generally maintained; and at any rate the practice now completely established and always adhered to is for ratifications of the treaty to be exchanged between the contracting parties before it comes into operation. And there are many instances of states declining to ratify or to act upon treaties which have been signed by their accredited representatives.

But even after a treaty has been ratified, it is really binding only so long as the contracting parties choose to adhere to it. It is plain that this must be so, from there being no superior authority which can enforce the observance of its engagements by any of the parties. Various contrivances indeed have been resorted to in different ages with the view of strengthening the moral bond constituted between independent political societies by a treaty: not to speak of oaths imposed with all possible solemnity, the invocation of the censures of the church, and other religious or ecclesiastical appliances; formerly sometimes pledges were deposited, and forfeits established; sometimes individuals were named as guarantees or conservators of the treaty, who, in case of its being violated by their own sovereign or feudal superior, were thereby absolved from their allegiance and placed under an obligation to assist with all their means the party seeking redress against him: down to a later date hostages were often given, a practice that is not yet gone quite out of use; and in the present day it is not unusual in a treaty between two powers to name some other state or states as having undertaken to guarantee its observance. But no such precautions that can be taken are found to have really much effect; the maintenance of a treaty will always principally depend upon the interests or the inclinations of the parties to it. If the parties should quarrel and go to war, the existence of the treaty will give no rights or advantages to either of them in the contest which it would not have enjoyed although there had been no treaty. The occurrence of actual hostilities, we may here remark, between countries that have been connected by treaties of alliance or commerce, or of whatever sort, is held to annul all such previously subsisting arrangements; and they must be formally entered into anew after the peace, if it be desired that they should come again into operation.

It is not however to be supposed, from what has been said, that nations will not ordinarily feel themselves to be in some degree restrained even by the moral obligations which a treaty implies, although there be no superior authority that can enforce their observance. A government would at least suffer in that not unimportant element of strength, its character, by lightly casting off the bond of a treaty into which it had solemnly entered. It has been customary accordingly in all such cases for explanations to be put forward by which it is attempted to be made to appear either that it is the other party which has really violated its engagements, or that the abandonment of the treaty has been unavoidable, or otherwise justified by circumstances. Such apologies, having any plausibility, are not always to be found when they are wanted without some trouble; and this difficulty may in some cases sustain a treaty for a time against a pretty strong disposition to get rid of it. Still it is always possible for a country which desires to break with another to find some pretence of quarrel, even apart from any of the engagements which they may have contracted with each other. Such engagements therefore are for the most part only to be depended upon so long as they are for the advantage of the one party as well as of the other. Hence the best and most durable treaty is always that which is the fairest and the most equal. But the main purpose and utility of a treaty, after all, is not that it may secure certain advantages to either party, but that it makes clear and fixes those relations between the two which would otherwise remain obscure, indeterminate, and subject to continual misconception or controversy. It will be found that all human laws and enactments which have any considerable stability are, in so far at least as they relate to matters of principle as distinguished from mere expediency, rather declaratory than anything else: they establish certain things, but these things for the most part have existed in another way before they were so established; they were ideas in the general mind, or they were customs imperfectly observed, and growing up into an ascendency, which the law only confirms and proclaims. But the advantages of this proclamation, whether by a law or by a treaty, are immense: independently altogether of the sanctions by which the law or the treaty may be enforced, or sought to be enforced, the effect of the mere distinct announcement which either makes is to substitute all the inestimable conveniences of certainty and order, in the room of fluctuation, doubt, and confusion.

In so far as what is called the law of nations is positive or determined, and not mere matter of argument and speculation, it is, with the exception only of a few usages of antient origin, to be all found in the treaties subsisting between the various nations of Europe and the states founded by European colonies in North and South America. It is remarked by the Abbé de Mably (in his 'Principes des Négociations'), that from the decline of the house of Charlemagne (in the ninth century) to the time of the expedition of Charles VIII. of France to Naples (in the end of the fifteenth), the several nations of Europe had scarcely any political relations with each other. But at the later of these dates, he afterwards observes, Italy was in this respect an image of what Europe is at the present day. The origin and history however of the political relations among the states of Europe may be sufficiently understood by being traced from the termination of the Thirty Years' War, at the peace of Westphalia in 1648. We subjoin an account of the more important general treaties which have been concluded since that date.

1648. Treaty signed by the Roman Catholic powers at Münster, and by the Protestants at Osnaburg, 24th October; and also treaty signed at Osnaburg on the same day between the emperor and the king of Sweden; and treaty between Spain and the United Provinces, signed at Münster on the 30th of January. By these treaties the constitution of the Germanic empire was defined and settled; the territorial and other rights and privileges of the several electors and princes being confirmed to them, and ecclesiastical affairs being regulated on the basis of the religious peace of 1555, and the imperial decree, entitled *Uti Possidetis*, of 1st January, 1624. The Upper Palatinate with the electoral dignity being conceded to the duke of Bavaria, an eighth electorate was created for the Count Palatine. The elector of Brandenburg obtained four votes at the diet, with the reversion of the archbishopric of Magdeburg, and the bishoprics of Camin, Halberstadt, and Minden, all which ecclesiastical benefices were secularized. To Sweden were assigned three votes, with Upper Pomerania, Stettin, the isle of Rügen, Weimar, and the secularized archbishopric of Bremen and bishopric of Verdun. To France was made over the sovereignty of Alsace, and of the three bishoprics of Metz, Toul, and Verdun. And the republics of Switzerland and of the Seven United Provinces of Holland were acknowledged as independent states. This peace however did not terminate the war between France and Spain.

1659. Treaty of the Pyrenees, signed between France and Spain, 7th November, in the isle of Faisans. The counties of Roussillon and Conflans were ceded to France, and also several cities in Flanders, Hainault, and Luxembourg, together with the greater part of Artois; of all which territories it was in possession at the time of the peace. Spain also renounced its pretensions to Alsace and other territories ceded by the treaty of Münster. The duchy of Bar and the county of Clermont were incorporated with France. The duchy of Lorraine, shorn of Bar and some other territories, was re-established; as were also those of Savoy, Modena, and Mantua; Juliers was restored to the elector-palatine; and France resigned all its conquests in Catalonia and in Italy. It was agreed that the Infanta Maria Theresa of Spain should marry Louis XIV. of France, resigning for herself and her descendants all right of succession to the throne of Spain.

1678-9. Treaties of Nimeguen: between France and the United Provinces, signed 10th August; between France and Spain, signed 17th September; and between the emperor and France, signed 5th February, 1679. By these treaties France restored the city of Maastricht to the Dutch, the garrison of Philipsburg to the emperor, and to Spain Charleroi, Courtrai, the duchy of Limbourg, the country of Outre-Meuse, and other towns and districts of which it had obtained possession. Spain gave up to France Franche Comté, together with Valenciennes, Cambray, and other towns in the Low Countries. The treaty of Westphalia was confirmed; the town of Freiburg was ceded to France by the emperor; and Nanci, which had belonged to the duchy of Lorraine, was also left in the hands of France, which, in fact, retained for the present possession of the entire duchy.

1697. Treaties of Ryswick: concluded by France with Holland, with Spain, and with Great Britain, 20th September; and with Germany, 30th October. The arrangements made with Holland and the emperor by the treaties of Westphalia and Nimeguen was generally confirmed. Strassburg, with its dependencies, was formally ceded by the emperor to France; which, on the other hand, resigned the other acquisitions from the emperor's territories it had made during the war beyond the bounds of Alsace, and also the cities of Friburg, Brisach, and Philipsburg, and consented to re-establish the duchy of Lorraine. Holland restored Pondicherry to France, and received back all the places France had taken from it during the war. To Spain France restored all its conquests both in Catalonia and the Low Countries, including Luxembourg, Charleroi, Courtrai, &c., with the exception of about eighty villages, &c., which it retained as being dependencies of Charlemont, Maubeuge, and other places which it continued to hold under preceding treaties. All conquests made during the war by France and Great Britain were mutually restored, and France acknowledged William III., and engaged not to furnish any succours to James II. By a treaty previously concluded with the duke of Savoy (at Turin, 29th August, 1696) France granted to that prince the fortress of Pignerol, and the privilege of royal honours for his ambassadors.

1713. Treaties of Utrecht: concluded by France with Great Britain, with Portugal, with Prussia, with Holland and with the duke of Savoy, 11th April; by Great Britain with Spain, 13th July; and by Spain with the duke of Savoy, 13th August. France acknowledged Queen Anne as queen of Great Britain, guaranteed the succession of the House of Hanover, and withdrew its protection from the Pretender; restored Newfoundland and Hudson's Bay, and ceded Nova Scotia and St. Kitt's to Great Britain; agreed to demolish the fortifications of Dunkirk; and engaged that the crowns of France and Spain should never be united in the same person. France consented that both banks of the river Amazons should be held to belong to Portugal; it being agreed that there should be no commerce between the inhabitants at the mouth of that river and the Portuguese at Cayenne. To Prussia France ceded Spanish Guelders, with the district of Kessel, Prussia renouncing all claims to the principality of Orange. France also acknowledged the regal title of the king of Prussia which had been assumed by Frederic I. in 1701. As fundamental articles it was stipulated,—1, That the kingdoms of France and Spain should never be united under the same head; 2, That no part of the Spanish Netherlands should ever be ceded or transferred to France, or to any prince or princess of French extraction. To carry out these principles it was arranged that Philip of Anjou (grandson of Louis XIV. of France), being recognised as Philip V. of Spain, should renounce all right to the crown of France; that, failing his descendants, the crown of Spain should go to the family of the duke of Savoy, now recognised as king of Sicily; and that the Spanish Netherlands, along with Menin, Tournay, and other towns of the French Netherlands ceded by France, being designed to serve as a barrier for the United Provinces against that country, should be made over to the emperor and the House of Austria, remaining as a deposit in the hands of the states-general till the emperor should become a party to the peace: as he did soon after by the treaty of Baden, signed 7th September, 1714. The electors of Cologne and Bavaria, which had been put to the ban of the empire, were re-established; but Sardinia, which had been assigned at Utrecht to the elector of Bavaria, was allowed by the treaty of Baden to remain in the possession of the emperor; to whom were also assigned (by the arrangements made at Utrecht) the kingdom of Naples, the ports of Tuscany, and the duchy of Milan, and (by those made at Baden) the towns of Brisach and Friburg in Brisgaw. The city of Rheinberg was restored by Prussia to the elector of Cologne. Nice and the other conquests made during the war were restored to Savoy by France; and it was agreed that the boundary between the two countries should be the summit of the Alps. Gibraltar and Minorca, which had been conquered by England during the war, were formally ceded by Spain; which also granted to England for thirty years the privilege of supplying the Spanish American colonies with negroes. [ASSIENTO.] A treaty of navigation and commerce between Great Britain and France, which was concluded and signed at the same time with the treaty of peace and friendship, was prevented from taking effect by the refusal of the British parliament to assent to a legislative measure, upon the passing of which its only material provisions (those establishing a complete equality of customs and duties, and reciprocity of commercial privileges in all respects, between the two countries) had been made conditional.

1718. Treaty of the Quadruple Alliance: signed at London, 23rd August, between France, the emperor, Great Britain, and Holland; acceded to by the duke of Savoy, 10th November; and by the king of Spain, 26th January, 1720. The object of this treaty was to compel the assent of the king of Spain to the arrangements made at the peace of Utrecht, which had left Philip V. and the emperor still unreconciled upon the question of the Spanish succession. The emperor now renounced all claim to the crown of Spain; granted to Don Carlos (Philip's eldest son by his second marriage) the reversion of the grand-duchy of Tuscany, and of the duchies of Parma and Placentia, to be held as fiefs-male of the empire, after the failure of the male issue of the Farnese and Medici families, in whose possession they then were; and ceded Sardinia and the regal title to the duke of Savoy: Philip of Spain renounced his claims to the Low Countries and to the possessions of the emperor in Italy; and both he and the duke of Savoy renounced, in favour of the emperor, their rights to Sicily, which Spain had recently conquered from Savoy.

1738. Definitive Treaty of Vienna: concluded between France and the emperor, 8th November; and assented to by the king of Sardinia, 3rd February, 1739, and by the kings of Spain and of the Two Sicilies, 12th April. The elector of Saxony was acknowledged king of Poland by the title of Augustus III.; his rival Stanislaus (the father-in-law of Louis XV. of France) resigning his rights, with the exception only of the regal title, and receiving in exchange the duchies of Lorraine and Bar (to be united however to France on his death, which they accordingly were in 1766). The grand-duchy of Tuscany, whose last sovereign of the house of Medici had died in 1737, was given to the duke of Lorraine. The kingdom of the Two Sicilies, with the ports of Tuscany, was guaranteed to its actual possessor, the king of Spain's son, Don Carlos, who on his part both renounced his right to Tuscany, and ceded to the emperor the duchies of Parma and Placentia. The emperor also recovered all the places that had been taken from him in the provinces of Milan and Mantua; except only the districts of Novara and Tortona, which, together with Campo Maggiore and some other fiefs, he ceded to the king of Sardinia. Finally, France guaranteed the decree, or Pragmatic Sanction, published by the emperor Charles VI. in 1713, by which he declared that, in default of issue male of his own body, all the Austrian dominions should descend to his daughter Maria Theresa, who had married Francis, formerly duke of Lorraine, now grand-duke of Tuscany.

1748. Treaty of Aix-la-Chapelle, signed by France, England, and Holland, 18th October; the preliminaries having been previously acceded to by the queen of Hungary (Maria Theresa, whose husband was now emperor, with the title of Francis I.), by the king of Sardinia, the duke of Modena, the king of Spain, and the republic of Genoa. All the preceding treaties, from that of Westphalia inclusive, were renewed, and generally confirmed; and all the conquests made during the war, which had begun in 1741, were mutually restored. Thus, France restored the Low Countries to the House of Austria; Bergen-op-zoom and Maastricht to Holland; Savoy and Nice to the king of Sardinia; and England restored Cape Breton to France. The duke of Modena and the Genoese also recovered all the territories they had enjoyed before the war. Silesia and Glatz were guaranteed to the king of Prussia; the Pragmatic Sanction of 1713 to the empress queen of Hungary; and the Hanoverian succession to the king of England, in favour of whom the king of France also engaged to expel the Pretender from his dominions. With regard to the fortifications of Dunkirk, it was stipulated that those on the land side should remain as they were, but that those on the sea side should be destroyed. And the Assiento was renewed to England for four years, in consideration of the previous contract having been interrupted for that space of time by the war. Finally, the duchies of Parma, Placentia, and Guastalla were ceded to Don Philip (the younger brother of Don Carlos, king of the Two Sicilies), who had married the daughter of Louis XV. of France; but it was declared that Parma and Guastalla should revert to the house of Austria, and Placentia to the king of Sardinia, in case either of the failure of the male descendants of Don Philip, or of his brother Don Carlos succeeding to the throne of Spain, on which it was assumed that Don Philip would become king of the Two Sicilies. But as the treaty of Vienna had secured the latter kingdom to Don Carlos and his posterity without any reservation, that sovereign refused to accede to the present arrangement; and in point of fact, when he succeeded to the throne of Spain in 1759, he bestowed the kingdom of the Two Sicilies on his third son Ferdinand, who accordingly reigned till his death in 1808 as Ferdinand IV.

1763. Treaty of Paris, signed by France, Great Britain, Spain, and Portugal, 10th February. England retained most of the conquests she had made from France during the war; including the factories on the Senegal, the islands of Grenada, the Grenadines, St. Vincent, Dominica, and Tobago, Cape Breton, with the islands and coasts of the gulf and river of St. Lawrence, and all Canada. The islands of Martinique, Guadaloupe, Mariegalante, Desirada, and St. Lucia, in the West Indies, and that of Goree in Africa, were given back to France; as were also the forts and factories she had formerly possessed in the East Indies, under the restriction however that she should keep up no military force in Bengal. And permission was given to her to fish on a part of the coasts of Newfoundland, and to occupy, but not to fortify, the islands of St. Pierre and Miguelon. The Mississippi was fixed as the boundary between the other possessions of the two nations in North America, everything on the left bank of that river being given up to England, with the exception only of the city of New Orleans. In Europe, France restored to England the island of Minorca, and also to the English king and his allies whatever conquests she had made in their German dominions. In return she received back Belleisle from England; and with regard to Dunkirk it was agreed that the fortifications should be kept in the state appointed by the treaty of Aix-la-Chapelle. To Spain England restored the island of Cuba; Spain in return ceding to England Florida, with the fort of St. Augustine and the bay of Pensacola, as well as whatever Spain possessed on the continent of North America to the east or south-east of the Mississippi, and also the right of cutting logwood in the Bay of Honduras. Whatever had been taken by Spain from Portugal, both in Europe and in America, was restored. By the treaty of Hubertsburg, concluded between the empress and Prussia, on the 15th of the same month, the empress surrendered to Prussia the province of Glatz and the fortresses of Wesel and Gueldres; and by another treaty concluded the same day between the king of Prussia and the elector of Saxony (Frederic Augustus III., king of Poland) the former restored all the territories he had taken from the latter. Finally, by a convention concluded at Paris on the 10th of June in the same year between France, Spain, and the king of Sardinia, it was agreed that the king of Sardinia should waive his right of reversion under the treaty of Aix-la-Chapelle to the duchy of Placentia on being secured by France in the same amount of annual revenue which he would have derived from the duchy.

1783. Treaties of Versailles: concluded by Great Britain with America, with France, and with Spain, 3rd September. The independence of the United States of America was acknowledged by England; and it was agreed that the boundaries of the United States should extend from the north-west angle of Nova Scotia (apparently intended to mean 'that angle which is formed by a line drawn due north from the source of St. Croix river to the Highlands') along the said Highlands, which divide the rivers emptying themselves into the St. Lawrence from those falling into the Atlantic, to the north-westernmost head of the Connecticut river, thence down the middle of that river as far as to N. lat. 45°, thence by a line due west to the river Iroquois or Cataraquy, thence along the middle of the said river into Lake Ontario, through the middle of that lake, along the water communication with Lake Erie, through the middle of that lake, along the water communication thence into Lake Huron, through the middle of that lake, along the water communication to Lake Superior, through Lake Superior, northward of the isles Royal and Phelipeaux, to the Long Lake, through the middle of that lake, along the water communication to the Lake of the Woods, through that lake to its most north-western point, thence due west to the river Mississippi, thence along the middle of the said river to what is by another extraordinary and incomprehensible form of expression called 'the northernmost part of the 31st degree of N. lat.,' thence '*south* by a line to be drawn *due east*' (such are the terms) to the middle of the river Apalachicola or Catahouche, along the middle of that river to its junction with the Flint River, thence straight to the head of St. Mary's River, thence along the middle of that river to the Atlantic Ocean, and finally from the mouth of the river St. Croix in the Bay of Fundy, along that river to its source, and thence directly north to the aforesaid Highlands, comprehending likewise all islands within twenty leagues of the coast of the United States, and lying between lines drawn due east from the points where the boundary-line thus described touches the Bay of Fundy and the Atlantic Ocean. The navigation of the river Mississippi, from its source to the ocean, was left free to both nations; and the right of fishing on the banks of Newfoundland was conceded, under certain restrictions, to the Americans. With France all former treaties were renewed, except in so far as altered by the present. England restored or resigned the islands of St. Pierre and Miguelon, St. Lucie and Tobago, Goree, and the forts and factories on the Senegal, the French establishments in Bengal, and at Pondicherry, Mahe, and Surat; and recovered from France in return the islands of Grenada and its dependencies, St. Vincent, Dominica, St. Christopher, Nevis, and Montserrat. All the regulations of former treaties with regard to the fortifications of Dunkirk were abrogated. All the conquests made from one another during the war by Spain and England were mutually restored; Spain giving back to England the islands of Providence and Bahama, and England ceding to Spain Minorca and East Florida; retaining, however, the right of cutting logwood in the Bay of Honduras. By a fourth treaty, concluded between England and Holland, at Paris, 20th May, 1784, all conquests between these two powers were mutually restored; and Holland ceded the town of Negapatnam with its dependencies.

1802. Treaty of Amiens: between England on the one part, and France, Spain, and Holland on the other, signed in French the 25th, English the 27th March. England restored to France and her allies all the conquests she had made from them during the war, except only the island of Trinidad taken from Spain, and the Dutch possessions in Ceylon. The Republic of the Seven Ionian Islands (formerly belonging to Venice) was recognised by France. Egypt was restored to the Porte. France engaged to evacuate the kingdom of Naples and the States of the Church; and England to evacuate Porto Ferraio, and whatever other ports and islands she occupied in the Mediterranean and the Adriatic. It was stipulated that Malta should be surrendered by England to the Knights of St. John of Jerusalem, to be held by them under the protection and guarantee of France, Great Britain, Austria, Spain, Russia, and Prussia; but Russia and Prussia having declined to undertake that guarantee, England refused to perform this article of the treaty. Her refusal eventually led to the recommencement of the war.

1814. Treaties of Paris, signed 30th May, between France on the one part, and Austria, Russia, Great Britain, and Prussia on the other. The limits of the kingdom of France were declared to be the same as they stood on the 1st of January, 1792, with the addition of Avignon and Vinaissin, and also certain augmentations on the north side. The navigation of the Rhine was declared to be free. It was agreed that Holland should be placed under the sovereignty of the House of Orange, and should receive an increase of territory; that the states of Germany should be independent, and united in a federation; that Switzerland should continue independent; that Italy, with the exception of the portions of it which were to be restored to the dominion of Austria, should consist of sovereign states; that Malta and its dependencies should belong to Great Britain; that Great Britain should restore to France all the colonies, fisheries, factories, and establishments of every kind which France possessed on the 1st of January, 1792, in the seas and on the continents of America, Africa, and Asia, with the exception of the islands of Tobago and St. Lucia, and the Isle of France and its dependencies; and that France should cede to Spain the French portion of the island of St. Domingo, and receive back Guadaloupe from Sweden, and French Guiana from Portugal. These arrangements were afterwards assented to by Spain, Portugal, and Sweden.

1815. Treaty of Vienna, signed 9th June, between Austria, Spain, France, Great Britain, Portugal, Prussia, Russia, and Sweden. The duchy of Warsaw, with the exception of certain provinces and districts, was united under the name of the kingdom of Poland, to the empire of Russia; the part of it belonging to Prussia was constituted into the grand-duchy of Posen; and Cracow was declared a free city under the protection of Russia, Austria, and Prussia. A portion of the kingdom of Saxony was made over to Prussia, under the name of the duchy of Saxony. Prussia also recovered the city of Danzig, and all the other territories she had possessed at the commencement of the war, except the grand-duchy of Posnania (comprehended in the restored kingdom of Poland), the district of Bialystock (annexed to Russia), and the principalities of Franconia (retained by Bavaria). It was agreed that the territories hitherto composing the electorate of Brunswick-Lüneburg should henceforth constitute the kingdom of Hanover, which should also include the principality of East Friesland, and certain other cessions made by Prussia; Hanover giving in exchange to Prussia the part of the duchy of Lauenburg on the right bank of the Elbe, and other territories. The dukes of Holstein-Oldenburg, of Mecklenburg-Schwerin, of Mecklenburg-Strelitz, and of Saxe-Weimar, were allowed to take the title of grand-dukes. Other cessions and exchanges were also made, and various relations were settled, between Prussia and the minor German principalities. The several sovereign princes and free cities of Germany were formed into a united body under the name of the Germanic Confederation, with a diet to sit at Frankfort-on-the-Main, under the presidency of Austria. The former United Provinces of the Netherlands, with the Belgic provinces and certain other territories, were formed into a kingdom, under the sovereignty of the prince of Orange-Nassau, to be called the kingdom of the Netherlands; and the greater part of the duchy of Luxemburg, now erected into a grand-duchy, was also ceded to the king of the Netherlands, and constituted one of the states of the Germanic Confederation. On the other hand the king of the Netherlands ceded to Prussia all the hereditary territories of the house of Nassau-Orange in Germany. The integrity and independence of the Swiss Confederation was recognised; and the Valais, the territory of Geneva, and the principality of Neufchâtel were added as three new cantons to the nineteen previously existing. The limits of the territories of the king of Sardinia were fixed generally as they had stood on the 1st of January, 1792, with the addition of the territory formerly composing the republic of Genoa, which was now converted into a dukedom. The emperor of Austria was recognised as legitimate sovereign of Istria, Dalmatia, Venice, the islands heretofore belonging to the Venetians in the Adriatic, the duchies of Milan and Mantua, the Tyrol, Friuli, Trieste, Carniola, Upper Carinthia, &c.; and also of the Valteline, Bormio, Chiavenna, and the territories formerly constituting the republic of Ragusa. The duchy of Modena was re-established; the duchies of Parma, Placentia, and Guastalla were conferred upon her majesty the empress Maria Louisa (wife of Napoleon); and the grand-duchy of Tuscany was restored to the archduke Ferdinand of Austria and his heirs (to whom it had belonged before the treaty of Lunéville, in 1801). The principality of Lucca was erected into a duchy, and bestowed in full sovereignty upon the infanta Maria Luisa (of Spain) and her male descendants. The Marches (or Marca di Ancona), the duchy of Benevento, and the principality of Ponte-Corvo were restored to the holy see; as were also the legations of Ravenna, Bologna, and Ferrara, so far as it lay on the right bank of the Po. Ferdinand IV., the king of the Two Sicilies, was re-established in the possession of Naples; and, by a separate treaty, certain regulations were laid down for the free navigation of the Rhine, the Neckar, the Maine, the Moselle, the Maese, and the Schelde. The arrangements thus made at the congress of Vienna form the last general settlement of the affairs of Europe.

For a complete account of the printed collections of treaties, the reader is referred to the 'Discours Préliminaire sur les différens Recueils de Traités publiés jusqu' à ce jour' (pp. 3-73), in the first volume of the 'Supplément au Recueils des Principaux Traités,' &c., by De Martens, 8vo., Göttingen, 1802. All preceding general collections are superseded by the great work of du Mont and Rousset, entitled 'Corps Universel Diplomatique du Droit des Gens, contenant un Recueil des Traités d'alliance, de paix, de trêve, de neutralité, de commerce, d'échange, de protection, et de garantie, de toutes les Conventions, &c. . . . . depuis le règne de l'Empereur Charlemagne jusques à present,' &c., &c. Of this work, the first four volumes, in folio (often bound in eight parts), edited by Jean du Mont, styling himself on the first titlepage 'Ecuier, conseiller et historiographe de Sa Majesté Impériale et Catholique;' on the others, 'Baron de Carels-Croon,' appeared at Amsterdam and the Hague in 1726. Du Mont died in 1727, but left prepared for the press the manuscript of the next four volumes, two of which were brought out in 1728, the other two in 1731, under the superintendence of Jean Rousset. They are also often bound in eight parts. Of these eight volumes, the 1st contains the treaties, &c. from A.D. 800 to 1357; the 2nd, from 1359 to 1436; the 3rd, from 1436 to 1500; the 4th, from 1501 to 1555; the 5th, from 1556 to 1630; the 6th, from 1631 to 1666; the 7th, from 1667 to 1700; the 8th, from 1701 to 1730. The eight volumes were followed by a Supplement, in five volumes, which appeared in 1739, also under the superintendence of Rousset. Of this supplement, the first volume consists of what s entitled 'L'Histoire des Anciens Traités,' drawn up by Professor Barbeyrac, of Groningen: part 1st (474 pp.), containing the treaties from B.C. 1496 to the commencement of the Christian era; part 2nd (387 pp.), those down o A.D. 813. Of the next two volumes (each consisting of wo parts), the first contains the treaties omitted in the original collection, from A.D. 315 to 1500; the second, the omissions from 1501 to 1730, and a continuation from 1731 o 1738. Finally, there are two volumes entitled 'Le Céémonial Diplomatique' (the materials of which were colected in part by du Mont, but were put in order by Rousset), pp. 781 and 860. The ceremonial of the court of Great Britain occupies pp. 447-535 of the second of these. Thus the entire work consists of 13 volumes, or 26 parts.

The collection of Du Mont and Rousset has been completed and brought down to the present day by the late George Frederic de Martens, professor of the Law of Nature and Nations at Göttingen, and his successors, in their work entitled 'Recueil de Traités d'Alliance, &c. des Puissances et Etats de l'Europe,' &c. &c., the first volume of which, n 8vo., was published at Göttingen in 1790. The original work consists of seven volumes, of which the 1st (in the 2nd edition, 1817) contains the treaties from A.D. 1761 o 1770; the 2nd (also 2nd edition, 1817), those from 771 to 1779; the 3rd (2nd edition, 1818), those from 1780 o 1784; the 4th (2nd edition, 1818), those from 1785 to 790; the 5th (2nd edition, 1826, revised and augmented y the Baron Charles de Martens, the nephew of the original compiler) those from 1791 to 1795, with those omitted n the preceding volumes; the 6th (1800) contains a supplement from 1762, with a continuation, to 1797; and the 7th (1801), a supplement from 1764, with a continuation, o 1801, and indexes for the whole work. Then follow four volumes entitled 'Supplément au Recueil des Principaux Traités, &c.; Précédé de Traités du XVIII^{eme.} Siècle, qui ne se trouvent pas dans le Corps Diplomatique de MM. Dumont et Rousset, et autres Recueils Généraux de Traités.' Of this supplement, volume 1 (published in 1802) contains the treaties from 1701 to 1749; volume 2 (1802), hose from 1751 to 1799, with indexes for the two volumes; volume 3 (1807), those from 1733 to 1804; volume 4 (1808), those from 1804 to 1807, with indexes for the whole 11 volumes. From this point the work proceeds in nine volumes (divided into 12 parts), under the title of 'Nouveau Recueil de Traités, &c. depuis 1808, jusqu' à présent' (the former title of 'Supplément, tomes 5, 6,' &c. being also preserved). Of the 'Nouveau Recueil,' vol. 1 (published in 1817) contains the treaties from 1808 to 1814; vol. 2 (1818), those of 1814 and 1815; vol. 3 (1818) a supplement from 1808, with a continuation to 1818, and indexes for the whole 14 volumes; vol. 4 (1820), a supplement from 1808, with a continuation to 1819; vol. 5, first part (by the Baron Charles de Martens, 1820), a supplement from 1808, with a continuation to 1822; vol. 5, second part (by Frederic Saalfeld, 1829), a supplement from 1815 to 1822; vol. 6, first part (by Saalfeld, 1828), the treaties of 1822 and 1823; vol. 6, second part (1828), those from 1824 to 1826; vol. 7, first part (1829) a supplement from 1820, and a continuation to 1827; vol. 7, second part (1830), a supplement from 1824, and a continuation to 1828; vol. 8 (1831), a supplement from 1825, and a continuation to 1830; vol. 9 (1833), a supplement from 1827, and a continuation to 1831. Then follows what is entitled (the former titles however being still continued) 'Nouveau Recueil de Traités, Nouvelle Serie,' by Frédéric Murhard, of which vol. 1 (published in 1836) contains treaties from 1826 to 1832; vol. 2 (1837), those from 1830 to 1834; vol. 3 (1837), those from 1827 to 1835; vol. 4 (1838), those from 1832 to 1836; vol. 5 (1839), those from 1830 to 1837; vol. 6 (1840), those from 1830 to 1838; vol. 7, first part (1840), those from 1830 to 1839; vol. 7, second part (1842), those of 1839, with an index to the volume; and the work is still in progress. There was also published in 1837 the first part of an index to the entire collection: it is stated, in the 'Avertissement' by the publishers to comprehend the contents of the second edition of the original work in eight (apparently a mistake for seven) volumes, and also of the six first volumes of the 'Nouveau Recueil;' thus going over the space of time from 1761 to 1826.

There is a very useful compendium, containing an account of the treaties entered into since the peace of Westphalia, by the late M. de Koch, first published in 4 vols. 8vo. at Bâle, in 1796 and 1797, under the title of 'L'Abrégé de l'Histoire des Traités entre les Puissances de l'Europe;' and since extended and brought down to the peace in 1815 by M. Schoell, under the title of 'Histoire Abrégée des Traités de Paix,' &c., 15 vols. 8vo., Paris, 1817, 1818. The treaties of 1814 and 1815 are contained in the 11th volume, which was the last published; those that follow containing supplementary matter and indexes. This compilation may be regarded as superseding the Abbé de Mably's work entitled 'Le Droit Public de l'Europe, fondé sur les Traités' (in the 5th, 6th, and 7th vols. of his collected works, Paris, 1794-5), which is also a history of the treaties that have been formed since the peace of Westphalia. It may be mentioned here that an anonymous treatise, published in 8vo., at London, in 1758, 'The Principles of Negotiations,' is a translation of Mably's 'Principes des Négociations,' designed as an introduction to his 'Droit Public.'

There are separate collections of treaties published in nearly all the countries of Europe, consisting for the most part of those treaties to which the country has been a party, and which therefore form the history of its connection with foreign states. Most of those collections also De Martens has enumerated in the discourse already referred to. Here we can only mention those that have appeared in our own country. Of these by far the most important is that entitled 'Thomæ Rymeri Fœdera, Conventiones, Litteræ, cujuscumque generis Acta Publica, inter Reges Angliæ et alios quosvis imperatores, reges, &c.,' in 20 volumes, folio, of which the first 15 were published at London, under the superintendence of Rymer, from 1704 to 1713, and the last five under that of his colleague Robert Sanderson, from 1715 to 1735. 'This work,' says De Martens, 'is the first of its kind that exists, whether for the purity of its sources, being drawn immediately from the archives of the kingdom, or for the richness of its materials for the epoch which it includes, namely, from A.D. 1101 to 1654.' A second edition of the first 17 volumes (the last of which is occupied with an index to those that precede) was published at London, under the care of George Holmes, in 1727; a third, including the whole 20 volumes in 10, and with considerable additions and improvements, was brought out at the Hague in 1739; and a fourth, augmented by many new documents, has been in part printed under the direction of the late Record Commission. In 1710 appeared, at London, the first volume, in 8vo., of 'A General Collection of Treatys, &c. among the Potentates of Europe, from 1648 to the present Time;' which was followed by a second volume, including the treaties, &c. 'from 1495 to the present time,' in 1713; and by a third and fourth, including those from 1642 to 1731, in 1732; in which year there also appeared a second edition of the second volume. This collection, which is dedicated, in the 3rd volume, to 'The Most Noble Sir Robert Walpole,' by the editor, who signs himself S. W., is a convenient book of reference for ordinary purposes, but cannot be quoted as an authority. De Martens, who has corrected an erroneous account of the work given by George Chalmers, states that he does not know if the first volumes are by the same editor as the last two; but the language used in the Introduction to the 3rd and 4th volumes seems to imply that they are. In 1772 was published at London, in 2 vols. 8vo., a 'Collection of all the Treaties between Great Britain and other Powers from 1688 till 1771;' to which was added, in 1781, a supplementary volume, containing the more antient treaties from the end of the fifteenth century, and also 'A Discourse on the Conduct of the Government of Great Britain in respect to Neutral Nations' (written in 1757), by Mr. Charles Jenkinson (afterwards earl of Liverpool). Of this collection a new and re-arranged edition, in 3 vols. 8vo., was published in 1785; and it is often referred to under the name of Jenkinson's Treaties, although that gentleman does not appear to have had in truth anything to do with the compilation of it. It was followed by 'A Collection of Treaties between Great Britain and other Powers,' by George Chalmers, Esq., 2 vols. 8vo., London, 1790. Upon this manual De Martens bestows the highest praise, calling it a model for works of the kind, and evidently the fruit of long study and profound and well-digested learning. The editor himself, at the end of his preface, in which he has given some account of preceding collections, says, 'I have already exposed my ignorance to the eyes of those who have made the knowledge of the interests of powers a profession, whilst I have only looked for entertainment amid other labours and other studies.' The collection however is a very useful one; the plan comprehensive, the arrangement clear and sensible; and, we believe, its accuracy may be depended on. It is the latest general collection of treaties which has appeared in this country: but the new treaties and other state papers are annually published by the Foreign Office; and there is a very convenient work entitled 'A Complete Collection of Treaties, &c. at present subsisting between Great Britain and Foreign Powers, so far as they relate to Commerce and Navigation, to the repression and abolition of the Slave Trade, and to the privileges and interests of the subjects of the high contracting parties,' compiled from authentic documents by Lewis Hertzlet, Esq., librarian and keeper of the papers, Foreign Office, 5 vols. 8vo., London, 1840.

For an enumeration of the principal works on the subject of treaties, and references to the passages in the writers on public law in which the subject is considered, the reader may consult the Introduction to De Martens's 'Précis du Droit des Gens Moderne de l'Europe, fondé sur les Traités et l'Usage,' 2 vols. 8vo., Paris, 1831; vol. i., pp. 132-166, 268-270, 316; and ii., 22-33, 63-69, 113, 216-234, 291-308. There is a very useful work by De Martens, entitled 'Cours Diplomatique,' 3 vols. 8vo., Berlin, 1801; of which the two first volumes (entitled separately 'Guide Diplomatique') contain an account of the principal laws of the powers of Europe and of the United States of America, relating to commerce and the rights of foreigners in peace and in war, and a list of the treaties and other public acts connecting these states, from the commencement of their diplomatic intercourse to the end of the eighteenth century; and the 3rd is entitled 'Tableau des Relations Extérieures des Puissances de l'Europe, tant entre elles qu'avec d'autres états dans les diverses parties du globe.' In the *Companion to the Almanac for* 1831, pp. 44-63, will be found 'A Chronological Table of the more important Treaties between the principal civilized Nations, with notices of the Wars and other events with which they are connected, from the beginning of the fourteenth century to 1830.'

TRE'BBIA. [Po.]

TREBIZOND, *Empire*, a fragment of the empire of Constantinople, was founded under the following circumstances:—The last male of the Comnenian family who reigned at Constantinople was the emperor Andronicus the tyrant, who was deprived of his throne in 1185 by Isaac Angelus. Isaac not only instigated the mob of Constantinople to inflict upon his captive rival those inhuman tortures under which he lost his life, but he also resolved to exterminate the whole Comnenian family. John and Manuel Comnenus were put to death, but two infant sons of Manuel, Alexis and David, were saved by Thamar, a Comnenian princess, who fled with the two children to Trebizond. This happened in 1186. The history of Thamar and the two young princes during the following 18 years is almost unknown: it appears however that they found refuge at the court of the queen of Georgia, whose name was likewise Thamar, and of her son and successor George. In 1204 Constantinople was taken by an army composed of French, Flemish, and Venetian crusaders, who deposed and killed Alexis V., Murzuphlus, and chose in his stead Baldwin, count of Flanders, who however became only master of a part of the empire: another part was given to the Venetians and to some French barons. The Greeks reluctantly obeyed Baldwin, and a great number of them assisted Theodore Lascaris, who succeeded in making himself independent in Nicaea. [THEODORE LASCARIS.]

The establishment of the government of the Latins was the signal for another insurrection in the eastern part of the empire. No sooner had Constantinople fallen, than Alexis and David Comnenus levied an army in Georgia, where they then resided, and, surrounded by a considerable number of the Greek aristocracy, overran the country of Trebizond. Alexis, the elder of the two brothers, assumed the title of emperor of Anatolia, a fact which has been doubted or denied by modern historians, but which seems to be proved by the critical investigations of Professor Fallmerayer into the history of Trebizond. This historian found many important facts in two manuscripts which he discovered at Venice among the papers of Cardinal Bessarion, one of which is a treatise on Trebizond written by Bessarion himself, and the other a chronicle of the imperial palace at Trebizond, the author of which is Panaretus.

While Alexis remained in the city of Trebizond, his brother David conquered a considerable part of Asia Minor. His opponents were the emperor Baldwin and his successors, several French barons, and especially Theodore Lascaris, the new emperor of Nicaea. After a long struggle, in which he evinced the qualities of an accomplished general, David was obliged to cede to the emperor of Nicaea all the conquests which he had made west of Cape Carambis. (1214.) David died soon afterwards without leaving any issue. During this time Alexis had to sustain the attacks of his old friend George, king of Georgia, who however was obliged to desist from his designs upon Trebizond, and to turn his arms against the Mongols. [GENGHIS-KHAN.] A war with Ghayáth-ed-dín, sultan of Koniah, proved fatal to Alexis, who was made prisoner, and only recovered his liberty after having ceded to his conqueror the town and the country of Sinope. Alexis I. died in 1222.

His successor was Andronicus I., Gidon, who belonged to a branch of the Comnenian family, and who had married a daughter of Alexis I. Andronicus I. died in 1235 after a reign of 13 years, and his successor was John I. Axuchos, the eldest son of Alexis I. John I. died in 1238, leaving an infant son, Joannicus, who was deprived of the crown by his uncle, Manuel I., the younger son of Alexis I. who reigned from 1238 to 1263. Andronicus I. was compelled by 'Ala-ed-dín Key-kobad, sultan of Koniah, to renounce his dignity of an independent sovereign; but Manuel I. delivered himself from this vassalage by joining the Mongols, who had overrun Asia Minor. Being however unable to recover his independence, he paid homage to the Mongols, and managed their barbarous pride with so much dexterity, that he succeeded in keeping his empire exempt from Mongol garrisons and governors. In 1253 Manuel I. sent ambassadors to St. Louis, king of France, in order to obtain one of his daughters for his wife, but St. Louis did not assent to this proposition. The successors of Manuel were Andronicus II., who died as early as 1266 (?); George I., who died in Turkish captivity about 1270; and John II., who reigned till 1297. John II. was a man of little energy: he might have become emperor of Constantinople, but he preferred a friendly alliance to the chances of war, and for that purpose married Eudoxia, the daughter of Michael Palaeologus, emperor of Constantinople. During the reign of John II. the Turks-Seljuks conquered the district of Chalybia. John II. was succeeded by his son Alexis II., who reigned from 1297 to 1330.

During the reign of Alexis II. the city of Trebizond was, next to Tana or Azof, the centre of the commerce of the Genoese and the Venetians with the countries around the Black Sea.

The successor of Alexis II., Andronicus III., reigned only two years, and was succeeded by his son Manuel II., a boy of eight years of age, who was deposed by his uncle Basil II., the younger son of Alexis II. The reign of Manuel II. and Basil II. was disturbed by aristocratical factions; one party was composed of those Greek families long settled in the country of Trebizond, and the other of the descendants of those nobles who had joined Alexis I.

after the conquest of Constantinople by the Latins in 1204. Basil II. died in 1340. His widow, Irene, succeeded in maintaining herself for a time at the head of the government; but she was soon deposed by Anna, an ambitious princess of the Comnenian house, who after a short reign ceded the throne to John III. This emperor died in 1344, and was succeeded by Michael I., who reigned till 1349. Calamities of every description desolated Trebizond during the short period from 1340 to 1349. Aristocratical as well as democratical factions were in a state of perpetual warfare with each other; the Genoese, in order to revenge the murder of some of their countrymen, conquered the town of Cerasus; the Turks ravaged the whole country; a dreadful conflagration destroyed the city of Trebizond; and the plague killed those who had escaped the flames or the sword of the Turks. The successor of Michael I. was Alexis III., a child eleven years old. During his minority, the regency was disputed between the aristocratical parties; but, supported by the clergy, the young emperor recovered his authority, and evinced the energy of a man wherever he had to fight with his rebellious subjects. He attacked foreign enemies with no less courage, but he was abandoned by fortune, or forsaken by his coward countrymen. His armies were defeated by Turkish adventurers, and his pride was humbled by one Megollo Lercari, a Genoese merchant, who avenged a personal insult by destroying the imperial fleet with two of his own galleys, and by forcing the emperor to grant important privileges to the merchants of Genoa. Alexis III. gave his sisters and daughters in marriage to Christian and Mohammedan princes, to buy their friendship or to prevent their hostility. He died after a reign of 41 years, and was succeeded by his only son, Manuel III.

Manuel III. was compelled in 1402 to submit to Timur, who was anxious to get possession of the Trebizond fleet, in order to lead his army to the shores of Greece. [TIMUR.] But this fleet consisted only of twenty galleys, while the Bosporus was defended by the united navies of the Venetians and the Greeks of Constantinople. For some years Manuel III. was a vassal of Khalíl-Sultan, nephew of Timur, and under-khan of Armenia, Pontus, and some adjacent districts. After having recovered his independence immediately after the death of Timur (1405), Manuel died in 1412. His successor, Alexis IV., who reigned from 1412 to 1445, or perhaps to 1449, paid tribute to Kárá-Yúsuf, prince of the Turkomans of the Black Horde, who married a Trebizond princess. Other princesses became the wives of several Mohammedan and Christian princes in Servia, Greece, and Asia Minor. Alexis IV. was besieged in his capital by Amürad I., Sultan of the Turks-Osmanlis, but the strong fortifications of Trebizond saved the empire. Alexis had three sons, Calo-Joannes, Alexander, and David. Calo-Joannes revolted against his father, put him to death, and succeeded him between 1445 and 1449, under the name of John IV. During the reign of this emperor Sultan Mohammed II. conquered Constantinople in 1453, and in 1455 he sent Khetir-Pasha against Trebizond; but John IV. saved his throne by paying an annual tribute of 3000 pieces of gold, the first payment of which the emperor's youngest brother, David, brought to Constantinople in 1456. It was not the power of the petty empire of Trebizond, but the name of the Comnenes, and the moral influence of the emperors over the Greeks, which annoyed the Sultan of the Turks, and obliged him to put an end to the last remnant of Greek independence. John IV. felt the danger of his precarious situation. He secretly formed the plan of a league with Hasan-Uzun, the khan of Diyarbekir, who was his brother-in-law, the Turkoman emir of Sinope, and several other independent princes of the Turkomans; but a sudden death prevented him from carrying this plan into execution. (1458.) His son, Alexis V., a child of four years, was deposed by the youngest brother of John, David, who ascended the throne.

The rumour of the intrigues of John IV. had reached Mohammed II.; and David I., knowing that he had to suffer for the crime of his brother, resolved to die or to recover his independence. He spent his treasures in equipping 20,000 soldiers and 30 galleys; and he took up the plan of his brother for forming a great alliance against Mohammed II. The warlike tribes of the Caucasus, from Armenia to the Kuban, the kings of Georgia and Iberia, Hasan-Uzun, and the Venetians, promised their assistance. Pope Pius II. sent an ambassador, Father Louis, to Trebizond, and excited Europe to a crusade. But the centre of the negotiations was the court of Philip, duke of Burgundy, who with his son, the Count of Charolais, afterwards Charles the Bold, was flattered with the idea of saving the East from the Infidels. David and Philip entered into a correspondence (Fallmerayer gives some of the letters, p. 266, &c.); ambassadors of several independent or rebellious princes and khans of Asia Minor appeared at Brussels; and some Burgundian ships sailed to the Mediterranean to announce the arrival of a fleet. But all these preparations were in vain. In 1461 Mohammed II. overran Asia-Minor. Hasan-Uzun begged for peace. Trebizond was besieged by sea and by land. Mohammed arrived before the city some time after the beginning of the siege, and immediately summoned David to save his life and his treasures by surrendering his capital. Unlike the last emperor of Constantinople, who died in the defence of his liberty, David surrendered. David, his family, and his nephew Alexis were carried off to Constantinople, and thence to Serres, where they were watched by Turkish spies. A letter from David's niece, Catherine, the wife of Hasan-Uzun, to her relations at Serres, which had been intercepted, informed Mohammed that his captives had formed the plan of escaping to Asia Minor. In consequence of this Mohammed ordered the imperial family of the Comnenes to be put to death. David, his nephew Alexis, and seven of his sons were executed; the eighth and youngest saved his life by adopting the Mohammedan religion, and died in obscurity. Anna, the daughter of David, became an odalik, or slave in the harem of Mohammed. Helena Cantacuzene, the wife of David, was spared. The bodies of David and his sons became 'a prey to the wolves and ravens,' and an order was given to kill any person who approached the place where they were exposed. Helena is said to have soon afterwards died of grief. (Fallmerayer, *Geschichte des Kaiserthums von Trapezunt*; Gibbon, *Decline and Fall*; Hammer, *Geschichte des Osmanischen Reiches*, vol. ii., p. 54, &c.; Le Beau, *Histoire du Bas Empire*; Chalcondylas, l. ix.; Ducas, l. xlv.-xlvii.; Phranzes, l. iii.)

TREBIZOND, *Trapesus*, Τραπεζοῦς, an antient town, situated on the Pontus Euxinus, in the eastern corner of the country of Pontus in Asia Minor. Trebizond was a colony of Sinope, a town founded by the Milesians. Xenophon with his 10,000 Greeks came to Trebizond in his retreat (*Anabasis*, iv. 8,) and remained there thirty days, according to Diodorus Siculus (xiv. 30), sacrificing to Jupiter and Hercules, and celebrated games. Near Trebizond the troops of Xenophon ate a certain kind of honey, after which they felt very ill for some days, but no one died. According to Tournefort, this honey was gathered by the bees from the following plants: 'Chamærhododendron Pontica maxima, mespili folio, flore luteo;' and 'Chamærhododendron Pontica maxima, folio Laurocerasi, flore caeruleo purpurescente' (*Voyage du Levant*, p. 224-231). During the wars between the Romans and Mithridates, who was master of Trebizond, this town fell into the hands of the Romans, and henceforth belonged to the Roman empire. Hadrian ordered the port to be secured by a mole. Pliny (*Hist. Nat.* vi. 4,) calls it 'Trapezus liberum oppidum,' or a 'free town.' Mela (i. 19, 85) employs the words 'Maxima illustris;' and according to Tacitus (*Hist.*, iii. 47) Trapezus, a very antient Greek town, was taken by Anicetus, the son of Polemo, who was a Roman vassal king of Pontus. This Anicetus pretended to take the town for the emperor Vitellius during the civil troubles that preceded the fall of Vitellius and the accession of Vespasian. Trebizond had its own medals, from the time of Hadrian: on some of them there is on one side an anchor, and on the other the prow of a ship, two emblems which seem to prove the importance of the commerce of this town. During the reign of Valerian (253-259 A.D. Trebizond was a large and opulent town, but it was taken plundered, and partly destroyed by Scythian barbarians, according to Zosimus (i, 33); but these barbarians were Goths. (Gibbon, *Decline and Fall*, c. x., p. 424, &c. ed. 1815.) During a long period Trebizond seems to have been only the shadow of its former splendour. Ammianus Marcellinus (xxii. 8) speaks of it only as a town, 'not obscure' (*non obscurum*); but it recovered during the wars with the Persians in the reign of Justinian. This emperor ordered the public buildings to be restored, a fact which is proved by an inscription discovered by Tournefort over the door of the castle of Trebizond, and which was copied by him (*Ibid.* p. 234). Trebizond afterwards became the capital of the thema of Chaldia, a province which contained the antient country of Pontus, and sometimes also some adjacent tracts of Armenia. The history of this town during the middle ages is related under Trebizond, *Empire;* and we shall only mention here that the Genoese constructed a mole in the port of Trebizond, which is now almost entirely destroyed, but the foundations of it are still extant; it seems that this mole was only a restoration of that of Hadrian. At present Trebizond belongs to the Turkish empire; its Turkish name is Tarabozan or Trabezun. It is the capital of the eyalet or province of Trebizond, which contains the sanjaks or districts of Trabezun, Gonia, and Batum, and is bounded on the west by the eyalet of Siwas; on the south by the eyalet of Erz-rúm; on the south-east by the eyalet of Kars; and on the east by part of the eyalet of Childir: its length from east to west is about 310 miles, its breadth varies from between 35 to 45 miles, except the eastern part towards Childir, which is a little broader: it is inhabited by the Lazes, a nation of Georgian origin, some tribes of which are independent, but there are also some Turks and a considerable number of Greeks. The capital, Trebizond, is the seat of the pasha of the province, and of a Greek archbishop. Its population according to Balbi is 50,000 inhabitants; Kinneir gives it 15,000; Tancoigne, 25,000; Saint Martin, 40,000; Fontanier, 60,000; and Dupré, 250,000. Each of these different statements may be true, although for a certain period only, the towns in Turkey being the refuge of the people of the surrounding country, who flock there in great numbers in time of war in order to escape death or captivity. According to Brant, the British consul at Erz-rúm, the population of Trebizond in 1835 was between 25,000 and 30,000 inhabitants among whom were 3500 to 4000 Greeks, 1500 to 2000 Armenians, and 20,000 to 24,000 Mohammedans, all of whom live within the walled part of the town, while the Christian part of the population lives without the walls. When Tournefort visited the town, the population was scanty, and extensive gardens and fields were contained within the walls. Among the public buildings the most remarkable are, the castle or citadel, partly of antient, partly of modern construction, situated in the middle of the town on a steep rock, the summit of which is flat as a table (*τράπεζα*, thence the name of the town); the bazar; public bath-houses of marble, of a beautiful architecture; the ruins of a temple of Apollo, part of which has been converted into a Greek chapel. Brant says that in 1835 there were no buildings of a more remote age than the Christian æra. The commerce of Trebizond has much increased since the navigation of the Black Sea has been opened to all nations, and especially since the establishment of steamers, by which this town has a direct and regular communication with Constantinople, Odessa, and the Danube. After Odessa, Trebizond is the first commercial port on the Black Sea; however, the antient port is almost filled up with sand, and larger vessels are obliged to cast anchor in the road. In 1830 only 5000 bales of European merchandise passed through Trebizond on their way to Persia, while in 1835 nearly 20,000 proceeded by the same track to the same destination. Surrounded by a range of high and woody mountains, the town presents a beautiful appearance from the sea. Trebizond is the birth-place of Cardinal Bessarion, who was born here in 1395. The family of George of Trebizond, the learned antagonist of Bessarion, was originally from Trebizond, but he was born in Candia. About 25 leagues south-east of Trebizond lies the famous convent of St. John, surrounded by beautiful forests, and situated in one of the finest solitudes in the world.

(Balbi, *Abrégé de Géographie*, 3rd ed., i., pp. 54, 661, 662, 666; Hammer, *Geschichte des Osmanischen Reiches*, vol. ix., p. 39; Strabo, pp. 497, 499, 548, 555, ed. Casaub.; Stephanus Byzantinus, s. v. Τραπεζοῦς; James Brant, Esq., 'Journey through a part of Armenia and Asia Minor in the year 1835,' in the *Journal of the Royal Geographical Society of London*, vol. vi. (1836), p. 187-91.)

TREBUCHET. [Tumbril.]

TRECATE. [Novara. Province of.]

TREDGOLD, THOMAS. From a very meagre biographical notice of this able engineer, in the seventh edition of the 'Encyclopædia Britannica,' we learn that he was born at Brandon, near Durham; but when is not stated. He received such a common education as is usual for youth brought up to mechanical employments, and was apprenticed at the age of fourteen to a carpenter in his native village, with whom he remained six years. He afterwards went to Scotland, where he worked for five years as a journeyman carpenter. From Scotland he removed to London, where he obtained employment in the office of an architect, in which he remained for ten years. During that time he employed his leisure in the diligent study of chemistry, geology, and the mathematics; and thereby prepared himself for the subsequent production of the scientific treatises to which he owes his principal reputation, and which were so highly esteemed abroad, as well as in England, that several of them were translated into French. The writer of the memoir above referred to states that he does not know when Tredgold began to practise as a civil engineer, but that it was while he was so engaged that he published his scientific works. Of these the following are the principal:—'Elementary Principles of Carpentry,' a treatise on the pressure and equilibrium of beams and timber frames, the resistance of timber, the construction of floors, roofs, centres, wooden bridges, &c., to which are appended many useful tables. This valuable work was published in 1820, in a thin 4to. volume, illustrated by twenty-two plates. 'A Practical Essay on the Strength of Cast-Iron,' originally published in 8vo. in 1822, and again, improved and extended, in 1824, in the same form; 'Principles of Warming and Ventilating Public Buildings, Dwelling-Houses, Manufactories, Hospitals, Hothouses, Conservatories,' &c., of which the second edition appeared in 1824, in an 8vo. volume; 'A Practical Treatise on Railroads and Carriages,' a work still held in repute, notwithstanding its early date in the history of railway science, published in a thin 8vo. volume in 1825; 'Remarks on Steam Navigation, and its Protection, Regulation, and Encouragement,' a pamphlet in the form of a letter to the late right honourable William Huskisson, then treasurer of the navy and president of the Board of Trade. This also was published in 1825. The last important work published by Tredgold was a thin 4to. volume, with numerous illustrations, entitled 'The Steam-Engine,' comprising an account of its invention and progressive improvement, with an investigation of its principles, and the proportion of its parts for efficiency and strength, &c. The first edition of this work was published in 1827; and so highly was it esteemed, that a posthumous edition, greatly extended by the contributions of several scientific men, especially in the department of steam navigation, was published in 1838. This truly beautiful edition is in two large 4to. volumes, illustrated by one hundred and twenty-five plates and numerous wood-cuts. It was edited by W. S. B. Woolhouse, and a portrait of Tredgold is prefixed to the first volume. He was also the author of several valuable articles in the 'Encyclopædia Britannica.' Tredgold died in 1834, leaving, notwithstanding the constant exertion of his talents, no adequate provision for his family.

TREDIAKOVSKY, VASSILI, or BASIL KIRILOVITCH, a Russian poet, of great but unfortunate celebrity, was born February 22nd, 1703. The place of his birth is not stated, but he is said to have received his first education in a school kept by a foreigner at Archangel, where he attracted the notice of Peter the Great, who, visiting the school, and ordering the boys to be drawn up for his inspection, after attentively looking at Trediakovsky, exclaimed, 'He will prove a most capital journeyman in his profession, but no master in it!' in allusion to which incident the poet remarks, 'The emperor was exceedingly shrewd, but was greatly mistaken in his opinion of myself.' On leaving the school at Archangel he studied at Moscow; and then, by the liberality of prince Alexander Kurakin, was enabled to visit France, England, and Holland, for the purpose of completing his education. While at Paris he attended Rollin's lectures, and made himself master of some of the modern languages. In 1730 he returned to Russia, in 1733 was appointed secretary to the St. Petersburg Academy of Sciences, and in 1745 was made professor of eloquence, on that office being first created. He died August 6th, 1769. Without talent for any one department of literature, Trediakovsky attempted all, from idyls and fables to tragedy and epic or heroic poetry. Of the last-mentioned kind is his 'Telemachida,' which is a versified paraphrase of Fénélon's 'Telemachus,' a production so dull, that Catherine II. used to inflict the task of getting a hundred lines of it by heart as a penalty upon those who infringed the rules established for her private parties in the Hermitage. Numerous as they were, his own poetical productions were but the smaller portion of his literary labours; for he translated several historical works, and among others Rollin's 'Antient History,' in 26 volumes, twice over, the manuscript of the first translation having been destroyed by fire, than which there is not perhaps a more singular instance of literary industry and perseverance upon record.

(Bantiesh-Kamensky, *Slovar Dostopamiatnikh Liudei.*)

TREE, COTTON. Two very distinct plants are confounded under this name. One is a true cotton-plant, the *Gossypium arboreum* of botanists, and the *Nurma* of the natives of India. The other is a species of Bombyx, or rather several species are called cotton-trees by travellers, from the capsules containing within them a silk-like substance, which has some resemblance to cotton, but none of the useful properties of cotton for spinning, and is therefore only used for stuffing beds and pillows.

TREES. The vegetable kingdom is frequently distributed into herbs, shrubs, and trees; and such a division constituted the basis of its classification by many of the older botanists. Herbs are plants whose stems live only for a single year. Shrubs have perennial stems, but have no trunk. [SHRUBS.] Trees are distinguished by possessing a trunk of varying size, from which spring a number of branches having a structure similar to the trunk. The classification of plants that would place trees all together is not a natural one, as it is making size a criterion of resemblance. In the most recent systems of classification, as those of Jussieu, De Candolle, and others, trees are found in all the principal classes. Thus amongst Exogens there are numerous examples, as the oak, elm, lime, &c.; amongst Endogens the palms; and even amongst Acrogens the tree-ferns. In the orders, trees, shrubs, and herbs frequently occur together, and even in some genera. Instances also occur of particular species being herbs in one country and shrubs in another, as the common mignionette. The division therefore of plants into trees, shrubs, and herbs, though convenient for practical purposes, and sanctioned by long usage, is not founded upon any essential difference in the character of the plants.

For practical purposes trees are divided into several kinds. Standard-trees, or standards, are those which are allowed to grow naturally to a great height without topping. Dwarf-trees are those which are not allowed to have more than one or two feet of trunk, being kept thus low by taking off the primary bud and allowing the collateral buds to develop. Forest-trees are those which are grown in large quantities for the purpose of affording timber. They have tall straight trunks and abundant foliage, and embrace all the large trees, as the oak, the beech, the elm, the pine, &c., that naturally grow together in large masses. Fruit-trees are such as bear edible fruits of various kinds, and are cultivated in orchards and gardens, such as the apple, pear, plum, cherry, &c. Wall-trees are those whose branches are extended against walls. They are mostly fruit-bearing trees, as the peach, plum, apple, &c.; sometimes however, for the sake of protection and ornament, trees whose fruit is valueless are planted against a wall.

Trees frequently attain a great age, and it is often a matter of importance to ascertain precisely the duration of their existence. In countries where the climate allows of a long cessation from the period of growth, as is the case in the temperate zones generally, this may be done with great accuracy by counting the zones of yearly growth in the trunk of a tree. But in climates where the deposition of wood is constantly going on, no marks exist in the stem of the yearly growth, and consequently no certainty can be arrived at of the age of the tree by its stem. It has been proposed to ascertain the age of trees whose diameter is known by ascertaining the size of a single zone; but as the size of the zones differs so much on the two sides, this is a very uncertain mode of pronouncing on the age of a tree.

Dr. Lindley, in his 'Introduction to Botany,' p. 95, gives some results of measurements of Indian trees, founded on the above rule, which are quite at variance with the known age of the trees. It is probably by some error of calculation of this kind that Adanson has given to some of the Baobab-trees (Adansonia digitata) of Africa the very great age of 5000 years; and De Candolle has computed the age of a specimen of Taxodium distichum as even much greater than this. On the whole it appears that it is only in trees of temperate climates, and belonging to the class of Exogens, and whose stems have a regular growth, and the whole of whose zones can be seen, that the method of counting the number of zones can be relied on as a means of discovering their age. This method is applicable to most of the trees growing in Great Britain, except where decay has removed the central portions of the trunk.

The rapidity of the growth of trees varies, but this is frequently dependent on climate, soil, and situation; and this is often remarkably exemplified in plantations where, according to the difference of soil, some trees will have grown with twice or three times the rapidity of others. Taking however all circumstances together, there are some trees that grow much more rapidly than others. The following table, showing the comparative increase in circumference of trees of different ages during two years' growth confirms this observation:—

	Circumference.					
	First Year.		Second Year.		Third Year	
	ft.	in.	ft.	in.	ft.	in.
Oak . .	0	10½	0	11½	1	0⅛
Larch . .	1	0½	1	3	1	4
Elm . .	2	7⅛	2	9	2	11
Lombardy Poplar	1	8	2	0	2	3¾
Lime . .	1	8⅛	1	10¾	2	0

Up to a certain point the larger a tree is, the more it will increase annually in size, on account of the larger number of leaves it bears, which are the organs which elaborate the sap from which the wood is formed. It is on this account that the practice of lopping the branches of trees is so injurious to their growth, as by taking away the leaves the sources of the formation of wood are destroyed.

The influence of season on the growth of trees is very remarkable. On looking at a section of the trunk of any large tree, it will be found that some zones are thick, whilst others are very thin. From some observations made on an extensive series of felled trees, we believe the thick and thin zones of wood correspond with hot and cold seasons. The difference in the thickness of the same zone on the two sides of the tree is probably to be attributed to the influence of prevailing winds, the function of the leaves on the side of the tree exposed to the wind being thus interrupted. Thus a wind blowing frequently, say from the north, during the summer will cause a larger deposition of wood to take place on the south than the north side of the trunk of the tree.

The duration of the existence of trees is very variable. The occurrence of decay by a species of slow combustion of the wood of the trunk seems to be the natural termination of their life. As long however as the decay spares enough tissue to transmit the sap from the roots to the branches, so long will the tree live and form new wood; and provided new wood is formed as fast as the old is destroyed, the tree is capable of existing to an almost indefinite period. This is not often the case; but still there are some instances recorded, as those of the Baobab and Taxodium before alluded to, of trees having existed for even thousands of years. The 'great chesnut' at Tortsworth is mentioned, in writings still extant, in the year 1135, and many other trees, especially oaks and chesnuts [QUERCUS (*Q. Castanea*)], might be mentioned, whose great size at present must lead to the inference that they have existed for a period considerably above a thousand years. In all instances of trees of great age decay has gone on in the centre of the tree, leaving frequently very large cavities, which have been used for various purposes. Thus the interior of the great oak at Allouville in Normandy has been converted into a place of worship. An oak at Kidlington has served as the village prison. The great oak at Salcey is used as a cattle-fold; others have served as tanks, tombs, prisons, dwelling-houses, &c.

For further information on the subject of trees the reader should consult Loudon's 'Arboretum et Fruticetum Britannicum,' and Selby's 'British Forest-Trees;' and the articles GRAFTING, PLANTING, EXOGENS, ENDOGENS, and of particular trees under their generic names, in this work.

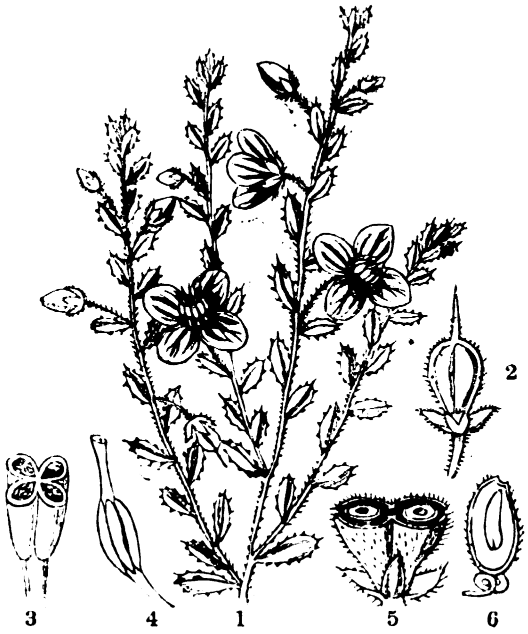
TREES, LAWS RELATING TO. [TIMBER.]

TREFOIL. [TRIFOLIUM.]

TREGONY. [CORNWALL.]

TREMANDRA'CEÆ, a natural order of plants belonging to the syncarpous group of polypetalous Exogens. This order consists of slender shrubs very much resembling heaths, usually covered with glandular hairs. The leaves are without stipules, either alternate or whorled, entire or toothed. The flowers are often large and handsome, seated on solitary axillary pedicels. The calyx has four or five sepals with a valvate æstivation; the petals equal in number to the sepals and much larger; the stamens hypogynous, double the number of the petals, with anthers 2- or 4-celled, opening by a pore at the apex; ovary 2-celled, with a simple style and stigma; seeds pendulous, and furnished with a caruncle at the apex; albumen fleshy, in the axis of which lies a straight cylindrical embryo.

This is an order of New Holland plants, containing but two genera, Tetratheca and Tremandra. Brown, who is followed by De Candolle, points out a relation between them and Polygalaceæ in their carunculate seeds and definite pendulous ovules. Lindley considers them as having an affinity with Rhamnaceæ, from which they differ in the possession of hypogynous stamens. Accordingly he places this order in his arrangement with Rhamnaceæ, Chailletiaceæ, Nitrariaceæ, and Burseraceæ. The properties of this order are not known. The genus Tremandra was discovered by Brown, and the name given on account of the peculiar perforation of the anthers.



Tetratheca glandulosa.

1, Cutting with flowers; 2, ovary with simple stigma; 3, 4-celled anther: 4, anther opening by a single pore; 5, section of capsule showing its two cells; 6, seed with the caruncle and embryo lying in albumen.

TREMBECKI, STANISLAW, one of the best Polish poets of the age of Stanislaus Augustus, was born about the year •1724, in the district of Cracow. Notwithstanding his eminence as a writer, and that during the greater part of his long life he moved in the higher circles of society, very few particulars have been preserved or collected respecting him. In his youth he spent many years in visiting various parts of Europe, and resided for a considerable time at the court of Louis XV. Afterwards he was for a length of time at that of Stanislaus, where he held the post of chamberlain. Later in life he withdrew almost entirely from society, rarely seeing any strangers, although he resided in the family of Felix Potocki at Tulczyn. At one time he had been remarkably abstemious, never touching either animal food or wine for thirty years, on which account Stanislaus used to call him his Pythagoras. Latterly he abandoned that rigorous system, which however does not seem to have had much influence upon his temperament, for he is said to have been engaged in no fewer than thirty duels, all of them arising out of some affair of gallantry, and in every one of which he came off conqueror. He died December 12, 1812, after very little previous indisposition, at nearly ninety years of age. Among his poetical works, all of which exhibit great mastery of style and beauty of language, that entitled 'Zofijowka' is considered his chef-d'œuvre. This production belongs to a species of poetry now in little esteem, it being a description of the gardens at Zofijowka, an estate in the Ukraine belonging to the Potocki family; but though the subject itself is not of the highest order, it is treated with great ability, and the whole abounds with striking beauties; nor is the reader's admiration at all lessened by its having been written when its author was between the age of seventy and eighty. The work however which would probably have most of all contributed to his reputation, namely, his 'History of Poland,' has never seen the light. The manuscript, consisting of two hundred sheets, was given in trust by him to a friend, that it should not be published until after his death; but what became of it has not been ascertained. There is a portrait of Trembecki prefixed to the two volumes of his poems, forming a part of Bobrowicz's 'Biblioteka Klassykow Polskich,' from which work the account here given is derived.

TREMELLA. [TREMELLINI.]

TREMELLI'NI, the name of the last order of the cohort Hymenomycetes, in Fries's arrangement of the natural order Fungi. The type of this order is the Tremella, a genus constituted by Dillenius, and applied to a variety of forms of Fungi belonging to this group, but now arranged under other genera. The Tremellæ of Dillenius included all kinds of the lower forms of plants which possessed a gelatinous character; and as these exhibited a tremulous motion on being shaken, he gave them this name. It was for a long time a matter of dispute amongst botanists as to where the Tremellæ should be placed. Linnæus arranged them with the Algæ, Persoon with the Fungi, and Smith as Algæ ambiguæ. As however their nature became better understood, many anomalous forms were removed from among them; and several genera having been formed, they are now arranged among the Fungi.

The plants of this order are known by their amorphous character, having a soft gelatinous appearance, and looking like gummy exudations of the substances on which they grow. Their sporidia are free. They have been at various times objects of superstition, and have also been employed in medicine. In the wooded countries where they are very common, the people call them 'witch-guts,' 'witch-meat,' and 'witches' butter.'

The genus Tremella is known by its receptacle being gelatinous, homogeneous, bearing fruit all round, and destitute of papillæ. The sporidia are submergent. It has a large number of species, of which nine are known as British. They are all of them found on the decaying branches, trunks, and stumps of trees.

T. fimbriata, fringed Tremella, plant clustered erect, wrinkled, at length black, with flaccid lobes. It has a violet colour when young. When boiled in water the plant does not lose its shape or colour, but yields a deep brown infusion, which might be made useful in dyeing. Bulliard obtained from it a pigment, which he used successfully in painting.

T. mesenterica, orange Tremella, or yellow Nostoc, is known by its orange-yellow colour, tough consistence, and twisted, lobed, and plicate form. This is one of the most common of the species, and is found all the year round on decaying branches and sticks, and on the stumps of trees. It varies much in size, sometimes having a diameter of four or five inches; at other times of not more than half an inch. It shrinks up in dry weather, becoming hard, and of a dirty brown colour, but again expands on the application of moisture. Its variety in form and colour has sometimes led to its receiving a new name; and great caution is necessary in order to the identification of all the species of Tremella.

T. albida, dirty-white Tremella. The plant is tender, sessile, dilated, slightly lobed, and waved; the edges obtuse; sporidia oblong, curved. This plant is found on fallen trees, branches, &c. in winter and spring. It bursts through cracks in the bark, and spreads itself in horizontal or clustered, rounded, white semipellucid masses, which are very gelatinous and tender when young, but afterwards turn of a yellow colour.

The genus *Exidia* is known by possessing a gelatinous, homogeneous receptacle, covered above only with a papillate hymenium. The most remarkable species of this genus is the *Exidia Auricula Judæ*, Jew's Ear. It has obtained its common name from its resemblance whilst growing to a human ear. The whole plant is sessile, concave, and flexuous, of a leathery consistence, and a reddish-brown colour. It is found mostly on living trees, especially the elder. It is generally from one to three inches wide. This plant was at one time held in much repute for its medicinal properties. It has an astringent character, and has been used in infusion as a lotion in ophthalmia, and also as a gargle in sore throat. It has also been used in the same cases as a poultice.

E. glandulosa, glandular Exidia, or Witches' butter, is an effused mass more or less plane, thick and undulated, varying from a whitish-brown to a black colour; the hymenium is covered with spicules. It is frequently found in autumn and winter on trunks and branches of trees, especially the ash. It is sometimes found on the under surface of a branch, having a bell-shaped form, and in this state it has been called Tremella flaccida. Its varied colour and form has caused it to have a great number of synonyms.

The genus *Dacrymyces* has a gelatinous homogeneous receptacle filled within with suberect flocci, and interspersed sporidia. This genus, sometimes called tear-mould, yields species which attack wrought wood, and produce what is called dry-rot. The *D. moriformis*, mulberry tear-mould, is of a rich deep purple colour, and is found on wrought wood in a clustered rounded form resembling a mulberry. The *D. violaceus*, violet tear-mould, has a violet-black colour, and is found on the trunks of pear and apple trees, resembling very much the crust of port wine.

D. stillatus, common Tear-mould, has a yellowish orange colour. It consists of suberect, rather thick, irregular branched filaments, articulated above, among which the sporidia are dispersed. It is found most frequently in the wood of firs.

There are three other genera belonging to the order Tremellini—*Næmatelia*, *Agyrium*, and *Hymenula:* they have each one species, and all of them were formerly described under the genus Tremella.

TRE'MITI, THE ISLANDS OF, a group of small islands in the Adriatic Sea, belonging to the kingdom of Naples, and lying N.W. of the peninsula of Mount Gargano, and about 16 miles N.N.E. from the mouth of the Fortore, the antient Frento. The group of Tremiti consists of three islands, separated by channels about half a mile wide: they are called respectively, San Domino, San Nicola, and Capperara, the last of which is a mere uninhabited rock abounding with capers. Fourteen miles to the E.N.E. is a small uninhabited island called Pianosa, and 65 miles N.E. of Tremiti is the island of Lissa near the coast of Dalmatia. The Tremiti islands form part of the administrative province of Capitanata, and on one of them, San Nicola, called also Tremiti, is a strong fortress with a garrison. This island is about three miles round, and consists of a lofty rock which is steep towards the sea. The adjacent island of San Domino is between five and six miles in circumference, and is more accessible and more productive, especially of oil and fruit of various sorts. On the eastern coast of the island facing the castle of Tremiti is a sort of harbour formed by several small islands or rocks, which however is far from being safe in all weathers.

These islands were called by the antients Diomedeæ, from a tradition that Diomedes was buried in one of them, now called San Nicola, where his monument or sanctuary was seen; the other island, now San Domino, was distinguished by the name of Teutria. (Pliny, *Hist. Nat.*, iii. 30.)

In modern times these islands were once inhabited by Benedictine monks and their servants and labourers; but a band of pirates from the coast of Dalmatia made an irruption upon the islands, killed the monks, and plundered the church and monastery. The islands then remained deserted for a long time, till Pope Gregory XII. at the beginning of the fifteenth century gave them to the regular canons of St. Augustin, called also Lateranenses, who took possession of them in 1412. The new possessors greatly improved and strengthened the place, and their order being wealthy, and having large estates at Catena and other places in the neighbouring provinces of Apulia and the Abruzzi, they built on the island of San Nicola a vast and splendid monastery and church, and a strong fortress, covering one-half of the island with buildings, surrounded by ramparts and bastions, and rendering it almost impregnable, like a little Malta, so as to enable them to resist the attack of a formidable Turkish fleet in 1567, an account of which has been written by Don Pietro Paolo di Ribera, one of the canons. The fortress of Tremiti was very useful when the Turkish and Barbary pirates used to infest the coasts of Italy, as they communicated by signals to the watch-towers on the mainland timely notice of their approach. The convent being afterwards suppressed, the islands reverted to the king of Naples, and the fortress of Tremiti has been used as a presidio, or place of confinement for prisoners, and occasionally state prisoners. (Cocarella, *Cronica Istoriale di Tremiti*, Venice, 1606, with plates.)

TREMOLITE. [Augite.]

TRENCH, in military works, is an excavation in the ground from 12 to 18 feet wide, and 3 feet deep, and generally of considerable length, the earth being thrown up on one side in order to form a sort of parapet by which the soldiers in the trench may be covered from the view, or protected from the fire of the enemy. [Sap; Siege.]

TRENCHARD, SIR JOHN, Knight, a secretary of state in the reign of William III., was born in 1650, and was the second son of Thomas Trenchard, Esq., of Wolverton in Dorsetshire, the then head of the antient and wealthy family of the Trenchards. Anthony à Wood gives the following account of Sir John Trenchard's birth and education: 'was borne of puritanical parents in Dorsetshire, became probationary fellow of New College in a civilian's place an. 1665, aged 15 years or more, entered in the public library as a student in the civil law, 22nd October 1668, went to the Temple before he took a degree, became barrister and councillour.' (*Athenæ Oxonienses*, vol. iv., p. 405, Bliss's edition.) The account characteristically proceeds, 'busy to promote Oates his plot, busy against papists, the prerogative, and all that way.' Trenchard was elected member for Taunton in Charles II.'s third parliament, which met on the 6th March, 1679, and was dissolved on the 12th of July in the same year. Anthony à Wood erroneously states that he was first elected in the succeeding parliament, which, having been called on the 1st October, 1679, was not allowed to aasemble until the same day and month in 1680. In this last-mentioned parliament Trenchard took a prominent part in the support of the Exclusion Bill, and was generally a zealous member of the opposition party. He was among those apprehended in 1683, on the suspicion of the Protestant plot, of which Lord Russell and Sydney were made the victims. It was told against him that he had engaged to raise a body of men from Taunton. He denied this on examination, and Lord Russell also denied all knowledge of it; but he was committed to prison. 'One part of his guilt,' says Burnet, 'was well known: he was the first man that had moved the exclusion in the House of Commons: so he was reckoned a lost man.' (*History of His Own Time*, vol ii., p. 357, 8vo. ed. 1823.) He was afterwards however discharged from prison for want of a second witness against him. (Evelyn's *Diary*, vol. iii., p. 106.)

After the accession of James II., Trenchard engaged to support the duke of Monmouth in his foolish invasion, and on the almost immediate failure of the duke's attempt he fled into France. (Dalrymple's *Memoirs of Great Britain and Ireland*, vol. i., p. 173.) He is said to have been dining with his relative, Mr. W. Speke, at Ilminster, when he received intelligence of the defeat of the duke of Monmouth's army at Sedgemoor; he immediately mounted his horse and advised Mr. Speke to do the same; he succeeded in making his way to Weymouth, where he took ship for France; and the story goes on to say, that at the moment he was embarking, his friend Mr. Speke was hanging before his own door at Ilminster. (Burke's *History of the Commoners*, vol. iv., p. 78.) He remained abroad till things had ripened for the Revolution of 1688.

Trenchard was member for Dorchester in the convention parliament which placed William and Mary on the throne. His services to William were rewarded by his being made, first, serjeant, then chief justice of Chester and a knight, and lastly, in the spring of 1693, secretary of state. He received this last appointment at the same time that Somers was elevated from the attorney-generalship to be lord keeper; and these two appointments were held of great importance, as being signs of William's desire to return to the Whigs, from whom he had for a time alienated himself. In the spring of the next year lord Shrewsbury returned to the other secretaryship of state, and the government was made completely Whig. Sir John Trenchard died on the 20th of April, 1695.

Opposite characters have been drawn of him by Anthony à Wood and bishop Burnet. The former calls him 'a man of turbulent and aspiring spirit.' Burnet's character of him is as follows: 'He had been engaged far with the duke of Monmouth, as was told formerly. He got out of England, and lived some years beyond sea, and had a right understanding of affairs abroad. He was a calm and sedate man, and was much more moderate than could have been expected, since he was a leading man in a party. He had too great a regard to the stars and too little to religion.' The last feature in the character which Burnet has drawn is illustrated by a story of Wood's. 'An astrologer told him formerly that he should such a year be imprisoned, such a year like to be hanged, such a year be promoted to a great place in the law, such a year higher, and such a year die, which all came to pass, as he told Dr. Gibbons on his death-bed.'

TRENCHARD, JOHN, a political writer of some celebrity in his day, was born in 1662. He was a member of a junior branch of the same family as the subject of the preceding article, and was the eldest son of William Trenchard, Esq., of Cutteridge in Dorsetshire, by Ellen, daughter of Sir George Norton, of Abbots Leigh in Somersetshire. On Sir George Norton's death in 1715, Mr. Trenchard, his grandson, inherited his property.

The writer of the life of Trenchard, in the 'Biographia Britannica,' has fallen into the error of making him the son of Sir John Trenchard, to whom he was but distantly related. The actual degree of relationship may be seen in Burke's 'History of the Commoners,' vol. iv., pp. 78, 79. This error has led to others. For instance, the writer represents him as having been born in 1669, instead of 1662, Sir John Trenchard himself having been born in 1650. These mistakes have been copied in Chalmers's 'Biographical Dictionary' and the 'Biographie Universelle.'

Mr. Trenchard was educated for the law, and was called to the bar. But his fortune not requiring that he should follow a profession, he left the bar for what was to him the more congenial pursuit of politics. The author of the Life in the 'Biographia Britannica' says, 'By the decease of an uncle, and a marriage to a gentlewoman with a considerable fortune, he came into the possession of a good estate, and the prospect of a much better, which also fell into his hands on the demise of his father in 1695, whom he succeeded likewise in the House of Commons, being elected a burgess for Taunton in 1695.' A great deal of this is incorrect. Sir John Trenchard died in 1695, but Mr. Trenchard's father did not die till 1710. Mr. Trenchard was elected for the parliament that met in 1695, but sat, not for Taunton, but for Wareham. And it is probable that the account of the fortune acquired by marriage, and by the death of an uncle, is a mistake arising out of Mr. Trenchard's inheriting, after his father's death, from his maternal grandfather, Sir George Norton.

In 1698 Mr. Trenchard published, in conjunction with Mr. Moyle, a pamphlet entitled 'An Argument showing that a Standing Army is inconsistent with a Free Government, and absolutely destructive to the Constitution of the English Monarchy.' The question of a standing army being at that time seriously agitated, this pamphlet is said to have produced a considerable effect. It was followed almost immediately by 'A Short History of Standing Armies in England.' In 1699 Mr. Trenchard was chosen by the House of Commons one of seven commissioners for taking an account of the forfeited estates in Ireland; and he was one of the four who signed the report including the private estate, or that which had belonged to James II. in right of the crown, which William had granted to his mistress, Lady Orkney. A warm debate arose out of this report in the House of Commons, which is to be read in the 'Parliamentary History.' The report was approved of by the House, but gave great offence to the king.

In 1709 Mr. Trenchard published 'A Natural History of Superstition;' 'Considerations on the Public Debts;' and 'A Comparison of the Proposals of the Bank and South Sea Company.' He published, in 1719, two additional pamphlets entitled 'Thoughts on the Peerage Bill,' and 'Reflections on the Old Whig.' In 1720 he began, in conjunction with Mr. Thomas Gordon, a Scotchman, whom he had taken some time before into his house, and employed as an amanuensis, a series of letters on political questions, under the signatures of Cato and Diogenes, which appeared first in the London, and then in the British, Journal; and in the same year, in conjunction with the same gentleman, he began a paper called the 'Independent Whig,' which was devoted to the subjects of religion and church government. [GORDON, THOMAS.] These two series of letters went on till 1723, on the 17th of December, in which year Mr. Trenchard died. The immediate cause of his death was an ulcer in the kidneys; but he is said, in another account, 'to have thought too much, and with too much solicitude, to have done what he did too intensely, and with too much vigour and activity of the head, which brought upon him many bodily disorders, and is supposed at last to have worn out the springs of life.' (*Biographia Britannica.*)

After Mr. Trenchard's death, Mr. Gordon collected Cato's letters, and published them in 4 vols. 12mo. In the preface to the work, he has sketched the character of his friend and benefactor, justifying his eulogy by saying 'that he has set him no higher than his own great abilities and many virtues set him; that his failings were small, his talents extraordinary, his probity equal to his talents, and that he was one of the ablest and one of the most useful men that ever any country was blessed withal.' Mr. Gordon also published, after Mr. Trenchard's death, the papers which had appeared of the 'Independent Whig,' in 2 vols. 12mo. and at the end of the second volume is printed a long Latin inscription on Mr. Trenchard's tomb, which had proceeded from Mr. Gordon's pen. This inscription is printed also in the notes to the life in the 'Biographia Britannica.' Mr. Gordon continued the 'Independent Whig' after the death of his coadjutor, and made two additional volumes. The four volumes of the 'Independent Whig,' and 'Cato's Letters,' have both passed through several editions. They both excited much interest when they were first published and for some time after; but are now little read or known.

Mr. Trenchard had married a daughter of Sir William Blackett, of Northumberland, but had no children. Of his widow we are told, that, 'finding Mr. Gordon very useful in managing her affairs, she continued him in her service, was much pleased with his company, and, having paid a decent tribute of tears to the memory of her deceased husband, entered some time after into a second marriage with this ingenious friend and companion, who had several children by her.' (*Biographia Britannica.*)

TRENCK, BARON FRANZ VON, was born at Reggio in Calabria, on the 1st of January, 1711. His father was a general in the Austrian service, and took him when only eleven years old to serve in the war against Spain. At this tender age he was present and actually fought at the battle of Melazio. He was afterwards sent to the military academy at Vienna, and having passed his examination with great distinction, he was appointed cornet in the regiment, Palfy. His extraordinary physical strength united with an uncommon degree of ferocity manifested itself very early, and brought him into many difficulties. When only seventeen, his father having refused to supply him with more money for his extravagancies, he applied to a farmer in the neighbourhood, and upon receiving a refusal there also, he cut the man's head off. This affair was hushed up with great difficulty, and he was sent to Russia, where by his military talents and dauntless courage he soon gained the friendship of Marshal Münnich, and was made captain of hussars. A short time after he had received his commission, he attacked a whole Turkish regiment near Bucharest, contrary to the express orders of his colonel, with his small troop, and gained a decided victory. Upon his return the colonel reprimanded him for his disobedience; he answered by a blow, which felled his superior officer to the ground. For this offence he was sentenced by a court-martial to be whipped out of the regiment, a punishment at that period still inflicted in Russia upon commissioned officers. While he was awaiting the execution of this sentence in his tent, he heard that a brisk engagement with the Turks was taking place, and Marshal Münnich being near, he called out to the marshal, and asked if he would pardon him, provided he brought back within an hour three Turks' heads. The marshal assented, and Trenck immediately leaped upon the first horse he saw, galloped into the very centre of the enemy, and returned to the camp within half an hour with four Turks' heads suspended from the pommel of his saddle. But shortly after he was sentenced to death for a still greater violation of discipline, and it was only through Münnich's influence that his sentence was commuted first into banishment to Siberia, and at last to six months' hard labour. This punishment he had to undergo at Kiew, and immediately after he retired to his estates in Croatia. The Austrian provinces on the Turkish frontiers being, after the war, infested with numerous and well-organized bands of robbers, Trenck voluntarily levied a force of a thousand men among his own tenants, and succeeded in a very short time in clearing the country of these dangerous enemies. A short time afterwards disturbances breaking out in Hungary on the occasion of Maria Theresa's succession to the throne, Trenck offered his own and the services of his men, his regiment of Pandours, as he called them, to the young empress. This offer was accepted, and Trenck went to Vienna. The disturbances were however soon pacified by Maria Theresa's heroic conduct at Presburg, and he was sent to the army on the Rhine and in the Netherlands under the command of Prince Charles. Here he again distinguished himself by his bravery and military skill, but at the same time by his rapacity and brutal ferocity. It was principally Trenck who covered Prince Charles's celebrated retreat into Bohemia, and on is march through Bavaria he took five fortified places in less than three weeks. It would lead too far here to relate he well-authenticated acts of plunder and cruelty which e committed, but he and his Pandours were as much readed over the whole empire, as Tilly and his men in the Thirty Years' War. In the following year he joined the rmy against Frederic the Great, and after the battle of orau (Sept. 14, 1745) he undertook to take the king by urprise at Collin, and to carry him off prisoner. In this he ailed with great loss of men; but he got a large booty, as e captured Frederic's tent and all that it contained. Upon is return to Vienna a court-martial was held over him, ome of his own officers accusing him of having received bribes from the enemy, besides unexampled cruelty and avarice. At his first examination one of the judges used ome disrespectful expressions towards Prince Charles; Trenck, with the fury and strength of a tiger, jumped at him, nearly throttled him, and would have thrown him out of a high window if the guard had not hastened to interfere. He was confined at Vienna for upwards of a year, when Baroness Lestock, a lady to whom he was betrothed, effected his escape by large bribes to his jailers, who connived at his feigning to be dead. He was carried in a offin to be buried, but as soon as the funeral procession had got outside the town gates, he jumped out of it, covered himself with a cloak, mounted a horse which stood prepared, and made his way to Bruges in the Netherlands, where he was however soon arrested again, and was taken, heavily loaded with chains, to Graetz. Here in a fit of despondency he took poison, and died October 4, 1747, leaving his great wealth to his cousin Frederic, who however did not derive much benefit from the bequest.

(*Mémoires du Baron Franz de Trenck*, écrits par F. de Trenck, 1 vol. 8vo., Paris, 1787; *Leben und Thaten der Trencke*, von Watermann, 2 vols. 8vo., Leipzig, 1837; *Mémoires du Prince de Ligne*, 2 vols. 8vo., Vienne, 1816.)

TRENCK, BARON FREDERIC VON DER, born at Königsberg, February 16, 1726. His mother was a von Dershau, and both parents belonged to the most antient and wealthy houses in East Prussia. His father had served with distinction as major-general in the Prussian army. The young baron distinguished himself very early by extraordinary precocity; in his thirteenth year he was entered as a student of law and belles lettres at the university of his native place, and passed the usual examination with great distinction. One year later he fought a duel with one of the most celebrated swordsmen at Königsberg, whom he wounded and disarmed. In his sixteenth year Count Lottum, one of his relations, and adjutant-general to Frederic (afterwards the Great), took him to Berlin, where the king immediately appointed him cadet, and soon afterwards, having himself upon one occasion been surprised at the young man's talents, he promoted him to a cornetcy in his body-guard, at that time considered the most splendid and gallant regiment in Europe, in which the rank of every officer was three degrees higher than in other regiments. The king's favour and his own amiable manners procured him many friends at court, but at the same time excited envy and malice. The foundation of his cruel fate is said to have been laid about two years afterwards at a ball given at the royal castle at Stettin, in celebration of the marriage of the princess Ulrike, the king's eldest sister, with the king of Sweden. The youngest sister, the princess Amalie, is said to have noticed him, to have invited him to see her at her private apartments, and to have cherished a violent passion for him ever afterwards. In an unguarded moment he is said to have boasted of the favours shown him by his royal mistress. This was reported to the king, who, although he did not think proper to punish his indiscretion, took a decided dislike to him, and watched every opportunity of visiting him most severely for trifling faults in military discipline. This story, embellished with many romantic incidents, originates principally with French writers, who in many instances contradict themselves as to dates and other matters. That an imprudent attachment between Trenck and the princess existed cannot be doubted; but that Frederic, violent and passionate as he was in all his private concerns, should have pretended blindness in so important a matter, and should even have continued to bestow favours upon the man who had dishonoured his sister's name, is difficult to credit.

During the war between Prussia and Austria he was placed on the king's staff, and distinguished himself on several occasions, particularly when his cousin, Franz Trenck, attempted to take the king prisoner by surprise at Collin. A short time afterwards his cousin addressed him a letter, returning him some of his horses which his pandours had taken upon one of their foraging expeditions. This circumstance he mentioned in presence of a Colonel Jaschinsky, who owed him a considerable sum of money, and who at Berlin was known to be his secret enemy. This man artfully persuaded him to a correspondence with his cousin, he himself undertaking to forward the letters by means of his mistress, the wife of the Saxon resident, Madame de Bossart. Several letters passed in this way open through Jaschinsky's hands, until he got possession of one in which some highly imprudent expressions were found, which he immediately caused to be laid before the king. The result was, that Trenck was cashiered and sent prisoner to the fortification of Glatz, not by a formal sentence, but by an order from the king, who expressed his intention at the same time to keep him there for one year; evidence enough, it would seem, that he only meant to punish his correspondence with the enemy, and no other or greater crime. At first he was treated according to his rank, and with all possible indulgence; but when it was discovered that he had several times, by bribes, attempted and nearly effected his escape, he was placed in close confinement. On the 24th of December, 1746, he nevertheless succeeded in making his escape, by the assistance of and together with Major Schell. With great fatigue and danger he reached his mother's residence in Brandenburg, whence he proceeded to Vienna, amply furnished with money. A strict investigation was ordered by the king, for the purpose of finding out how he had effected his escape; the result of which was the discovery that large sums had been remitted to him by the princess Amalie. It is highly probable that this was the first time that Frederic knew of his sister's attachment; and from this period must be dated his intense and obdurate hatred of Trenck. In the mean time Trenck had got into fresh troubles at Vienna, which he himself principally attributes to the intrigues of his cousin Franz, notwithstanding he was in prison at the time on a criminal charge. He left Vienna in disgust, and went to Russia, where, through the recommendation of the English ambassador (to whom Frederic himself had introduced him at Berlin, under the flattering title of *Matador de ma jeunesse*), he was well received, and appointed captain of a troop of hussars. Here he might have lived peaceably and content, being in high favour with the empress, and having acquired considerable wealth through a legacy of a Russian princess; but the Prussian ambassador, Count Goltz, left nothing undone to injure him, pretending that he acted thus in accordance with instructions from the king his master. His cousin at Vienna, who was now dead, had made him his heir. Upon this he determined to leave Russia; and after having visited Sweden, Denmark, and Holland, he returned to Vienna to take possession of his inheritance. Fresh difficulties awaited him there. His cousin's estates were under sequestration, and after vexatious and expensive suits he agreed to a compromise, by which he received 75,000 florins, and the appointment of a captaincy in a regiment of hussars. In 1748 he went to Prussia to visit his family; and at Dantzig, when on the point of embarking for Sweden, owing to some hints of impending danger which he had received, he was arrested by a party of hussars, and taken prisoner to Berlin. He was at first treated well, but his intemperate language, and even threats against the king, hurried on his fate. He was taken to Magdeburg, and confined in a cell underground, and almost without light. His sufferings, and his bold, desperate, and almost successful attempts to escape, may be read in his own Memoirs. After two soldiers had suffered death for conniving at his attempts to regain his liberty, and several other plots had been discovered, a prison was at last built on purpose for him, in which he was chained to the walls with fetters of sixty-seven pounds weight. Here he remained above four years more, till at last his relations succeeded in softening Frederic's obduracy; and on the 24th of December, 1763, he was released upon condition of leaving the kingdom. He went first to Vienna, where he was again arrested on account of his violent language against Frederic. The emperor however having convinced himself by a personal interview that his words were the mere outbreak of unmeaning rage after his dreadful sufferings, set him free, paid him the arrears of his salary as a captain, and advised him to retire in order to recover his health and his spirits. He settled at Aix-la-Chapelle, married a daughter of the burgomaster De Broe, and commenced business as a wine-merchant. He went several times to England upon commercial affairs, but notwithstanding all his exertions his affairs did not prosper, and he became a bankrupt. After this new misfortune he wrote articles of rather a democratic tendency for several periodical publications; and in 1787, after the death of Frederic the Great, he published his Memoirs, for the copyright of which he received a very large sum. From that time he became for a time a distinguished person in the world. His book was translated into almost all European languages; the ladies at Paris, Berlin, and Vienna wore rings, necklaces, bonnets, and gowns à la Trenck, and not less than seven different theatrical pieces in which he was the hero were brought out on the French stage. The year following he once more visited Berlin; but although he was kindly received by the king, it seems that he was disappointed in his expectations, and he returned to Aix-la-Chapelle, where he commenced the publication of a weekly paper, under the title of 'L'Ami des Hommes,' in which he proclaimed himself a champion of the new French doctrines. Meeting with little encouragement, he went to Paris in 1792, joined a Jacobin club, and was afterwards a zealous adherent to the Mountain party, which nevertheless betrayed, accused him, and brought him to the guillotine on the 25th of July, 1794. Yet on the scaffold, and in his sixty-eighth year, he gave proofs of his ungovernable passions. He harangued the surrounding multitude, and when his head was on the block he once more attempted to give utterance to his vehemence, and the executioner had to hold him by his silver locks to meet the fatal stroke.

(Friedrich Trenk's *Merkwürdige Lebensgeschichte von ihm selbst beschrieben*, 2 vols. 8vo., Berlin, 1787; *Méditations du Baron de Trenck dans sa Prison à Magdebourg, avec un précis historique de ses malheurs*, 1 vol. 8vo., Paris, 1788; *Denkwürdigkeiten von Freyherrn von Dohm*, Berlin, 1812; D. Thiébault, *Frédéric le Grand, ou Souvenirs de vingt ans de séjour à Berlin*, 2 vols. 8vo., Paris, 1801; *Leben und Thaeten der Trenke von Watermann*, 2 vols. 8vo., Leipzig, 1837.)

TRENT. [TYROL.]

TRENT, COUNCIL OF, CONCI'LIUM TRIDENTI'NUM, the last œcumenical council of the Latin or Western Church, was first convoked by a bull of Pope Paul III., dated May, 1542, for the avowed purpose of restoring peace to the church, distracted as it was by the schism of Luther and the other reformers. The papal legates, one of whom was Cardinal Reginald Pole, proceeded to the town of Trent, which was fixed upon for the meeting of the assembly, being a kind of neutral ground between Germany and Italy. The pope had enjoined them to invite all Christian princes, and especially the king of France, and Charles V., emperor of Germany and king of Spain, to send to Trent the bishops of their respective dominions. But neither Francis nor Charles, who were then at war with one another, appeared ver willing to comply with the pope's request; and th legates, not finding a sufficient number of prelates assembled, did not open the council. Meantime Charles V. was negotiating with the German Protestants, who had already three votes in the college of the electors of the empire, namely, those of the electors of Brandenburg and of Saxony, and of the elector palatine, and now claimed a fourth vote, which would have assured them the majority, being that of Hermann, archbishop of Cologne, who had seceded from Catholicism. This claim however was overruled. the clergy of Cologne adhered to the antient faith, a appealed to the emperor and the pope. The pope excommunicated and deposed the archbishop, and ordered the chapter to make a new election, and the emperor sent troops to expel Hermann and instal the new archbishop-elect. Charles however still persevered in his hope object of effecting a union between Protestants and Catholics: he devised conferences or consultations for the purpose, to which he invited theologians of both parties, but all to no purpose. He also held forth the prospect of a general council; but the Protestants replied, that as the assembly was to be composed of Roman Catholic prelates, they would not recognise its authority, which must of necessity be hostile to them and their doctrines. Charles however stood in need of the Protestant princes, in order to be enabled to manage the affairs of the empire, and to carry on his war against the Turks. He knew also that his rival, Francis of France, who was persecuting the Huguenots in his own dominions, was secretly instigating the German Protestants to resist the emperor. Charles convoked a diet at Speyer in 1544, in which a kind of *status quo* concerning the material interests of the people and clergy of both communions was agreed upon, until a future diet should decide permanently on the settlement of the points of contention. The pope was angry at this, which he considered a weak condescension on the part of Charles, and he wrote to the emperor, in August, 1544, a strong letter of censure. Meantime the peace of Crespy, between Francis and Charles, having removed some of the obstacles to the opening of the council, Pope Paul sent again the legates to Trent to proceed to instal the assembly, which ceremony took place on the 13th of December, 1545. Only four archbishops, twenty bishops, five heads of monastic orders, three papal legates, and an auditor, besides the imperial orators or envoys, were present on that day. The other prelates afterwards gradually joined the assembly. After hearing mass and a sermon in the cathedral, the prelates, being seated, were asked by Cardinal del Monte, first papal legate and president of the council, whether it pleased them, 'for the glory of God, the extirpation of heresy, the reformation of the clergy and people, and the downfall of the enemies of the Christian name, to resolve and declare that the Sacred General Tridentine Council should begin and was begun?' To which the assembled fathers replied singly 'Placet.' It was next resolved in the same form that the first session should be holden on the 7th of the following January. Te Deum was then sung; and the fathers, having taken off their pontifical robes, returned to their respective dwellings. Committees were appointed to regulate preliminary matters of form and proceeding. The French bishops insisted that to the title of 'Œcumenical Tridentine Council' should be added the words 'representing the Universal Church,' as had been done at Constance and Basle. The legates however opposed this as inopportune, and tending to alienate still more the seceders from the church. It was also remembered that the councils of Constance and of Basle had added the declaration that 'the council held its authority immediately of Christ, and was above all other dignities, the papal dignity included.' This would have been unsettling a delicate point, and the legates avoided it by observing that the council of Constance had assumed a right of supremacy because at that time the church was in a state of schism between several pretenders to the papal see, and as for the council of Basle, that assembly, after its quarrel with Pope Eugenius, was no longer considered legitimate. The words suggested by the French bishops were ultimately left out.

Another preliminary question was, whether the votes should be given by nations, so that the prelates of each nation should have only one vote all together, or by individuals. The legates insisted upon the latter mode being adopted, and they carried their point, a matter of importance when it is considered that the Italian bishops were proportionally more numerous than the rest.

The council had been professedly convoked for two great objects: one, the definition of the dogmas of faith, and the condemnation of heresies, and the other the reform of the church in matters of discipline and jurisdiction. The German bishops, supported by the envoys of the emperor, urged hat the labours of the council should begin with the business of reform, as it was the relaxation of discipline hat had first occasioned the present schism in the church, and that the only chance of reclaiming the seceders was to manifest an earnest will to reform abuses before proceeding to condemn them and their tenets; that if the council did not take in hand speedily the work of church reform, he lay powers would take it up themselves, to the manifest injury of the ecclesiastical authority. The bishop prince f Trent spoke at length on this side; as, being on the hreshold of Germany, he was acquainted with the state of pinions in that country, and the majority of the prelates seemed to incline to his opinion. The papal legates however, supported by the Italian prelates, were of opinion that the ouncil should begin with defining the dogmas, as that was the highest task, and ought to be first attended to, ecause faith is the foundation of all moral virtues; that he outcry about reform was well known to be mainly irected against the court of Rome and its jurisdiction, and was an indirect attack upon the authority of the sovereign pontiff, towards whom it would be more reverent to leave him the initiative in correcting the abuses of his own court, while the council was attending to the graver questions of religion, otherwise dissensions would arise between the head and the body of the church, only to the advantage and satisfaction of heretics. Would the bishops assume the functions of judges over their supreme pastor, and proclaim the superiority of the council above him, as hose of Basle had done? The pope could not, either n respect of his dignity or his conscience, submit to such an assumption, and would resist it strenuously, as it tended not only to overthrow the pontifical authority, but also to hrow the whole spiritual hierarchy and the church itself nto disorder and anarchy. After a lengthened discussion Cardinal del Monte, the head legate, acknowledged the existence of many abuses; but, he said, the abuses were o be found not only in the Roman court, they existed in ll orders of persons and in all ranks of ecclesiastical dignities; that he should therefore give the example of renouncing his pluralities and curtailing his establishment and educing his expenses, and he hoped other fathers would o the same for the edification of the Christian world. This produced a strong sensation in the assembly, and the bishop prince of Trent said that he was ready, if the council so pleased, to renounce the see of Brixen, retaining only hat of Trent; but the proposal was not responded to by he other prelates, and at last, in order to conciliate all parties, it was resolved that the two departments of doctrine and discipline should be proceeded with simultaneously, that for every sitting congregation engaged in discussions on dogma, there should be another concerning he reform of discipline; and this resolution was at last agreed to by the pope.

The council, at the beginning of its regular session, undertook to define first of all what were the sources of authority in matters of faith. It declared that the Catholic doctrines are contained in the authentic books of the Old and New Testaments, and also in the traditions concerning faith and morals which are preserved in the Catholic church. This was a condemnation of Luther's assertion that all the doctrine of the Christian faith is contained in the Scriptures, and that unwritten tradition is not to be held as authority.

The council next proceeded to define the dogmas of faith, such as those of original sin, predestination, grace, and free will, the definition of which may be seen in the catechism published by the name of 'Catechismus ad Parochos,' or 'Catechism of the Council of Trent,' which is translated into most languages.

While the council was thus occupied, Luther, the immediate originator of all this controversy, died at Eisleben in Saxony, in February, 1546. Shortly after war broke out between the emperor Charles V. on one side, and the duke of Saxony and the landgrave of Hesse on the other, and the fathers assembled at Trent were at one time alarmed for their own safety. The war however having rolled on towards the north, the council continued its labours, and propounded the doctrine of the church concerning the sacraments, which they stated to be seven in number, namely, baptism, confirmation, the eucharist, confession or penitence, extreme unction, ordination, and matrimony; and afterwards they proceed to treat of each of them seriatim, laying down the orthodox doctrine and anathematizing the discordant tenets of the Lutherans, Zwinglians, and other heretics. At the same time the council proceeded with discussions on subjects of discipline and reform. The question of pluralities proved a most difficult one to settle. The Spanish bishops made a strong remonstrance against the abuses of pluralities and non-residence, and wished the council to pass at once severe decrees against both. The legates proposed that the pope should take into his own hands the task of reform, and they wrote to Rome accordingly, and the pope directed a bull to the council by which he referred the matter to himself. This bull met with great opposition and was a source of misunderstanding between Rome and the council. At last, in March, 1547, the legates suddenly closed the session, which was reckoned the seventh since the opening of the council, and in virtue of the authority they held from the pope they transferred the council to Bologna, under the plea that a contagious disorder had broken out in the city of Trent. The majority of the prelates assented, but there were eighteen bishops, chiefly of the dominions of the emperor, who refused to leave Trent. The others followed the legates to Bologna, where, after opening the session, the council was adjourned *sine die*. Charles V. protested against the meeting of Bologna, which he did not acknowledge as a council, and insisted upon the council being restored to Trent.

In 1559 Pope Paul III. died, and his successor Julius III. again convoked the Council at Trent, in May, 1551. Not many prelates attended. The French king, who was at the time on bad terms with the pope, on account of the disputed possession of Parma, forbade his bishops to repair to Trent, on the plea that they could not go there in safety; and he talked of convoking a national council in France. The Council of Trent proceeded however to define the doctrine of transubstantiation, the Lord's Supper, and the mass, and afterwards that of confession and the other sacraments. At the same time decrees were made concerning points of discipline, touching the episcopal jurisdiction, the appeals to Rome, and other such matters. This session of the Council is remarkable, inasmuch as there were present ambassadors of Maurice, elector of Saxony, of the elector of Brandenburg, and several Protestant divines from Wittenberg and Augsburg, who, having obtained a safe conduct from the Council, were requesting a conference on the controverted doctrines. But the news of the revolt of Maurice of Saxony against the emperor, and of the progress of his arms in the spring of 1552, scared away most of the prelates, and Pope Julius soon after prorogued the Council by a bull, and the legates returned to Italy. The president, Cardinal Crescenzio, who had been some time infirm, died on arriving at Verona.

This prorogation of the Council continued for ten years, during which period three popes died in succession, Julius III., Marcellus II., and Paul IV. At last Pius IV. being elected, began to think seriously of re-opening the general council, of which the church seemed to stand more in need than ever.

In 1561 Pope Pius IV. having issued a bull for the re-opening or resuming the sessions of the Council at Trent, the Fathers gathered again in that town, and on the 18th of January, 1562, the session was solemnly opened in the cathedral of Trent by the papal legates, one of whom, the Cardinal Gonzaga, was named president by the pope. One hundred and twelve, consisting of archbishops, bishops, and mitred abbots, were present, besides the cardinals. The orators of the various states were also present. The archbishop of Reggio, after delivering a sermon, asked the Fathers 'if it was their pleasure that the holy, œcumenical, and general Tridentine Council be celebrated according to the tenor of the letters of the Holy Father and Lord Pius IV., and that those matters be treated in due order which, on being proposed by the papal legates and the president of the Council, shall appear to the holy synod fit and suitable to relieve the calamities of the times, to restrain the evil tongues of slanderers, to correct the abuses of morals, to cure the church of its evils, and to bring about the peace of Christendom.' To which all answered 'Placet,' with the exception of the archbishop of Granada and the bishops of Leon, Orense, and Almeria in Spain, who objected to the words 'on being proposed by the legates,' as restricting and trammelling the deliberative faculties of the assembly. It was in fact a question on the right of initiative, as it is called in our days. After some debate the words were approved. The next difficulty was started by one of the French envoys or orators, De Lansac, supported by the imperial envoys, who wished that the present council be called a new one, and not a continuation of the former. As the Protestants had refused to acknowledge the early acts of the Council, the declaring the present Council to be a continuation of the former was like shutting the door against reconciliation with them, an extremity dreaded by the court of France, where the Huguenots were powerful and threatening. The pope had purposely employed the word 'resuming' as a middle term, and he maintained his point.

The Council now proceeded to regular business. The legates proposed several questions of discipline, the principal of which were—to render obligatory the residence of ordinaries in their sees and of incumbents in their parishes; 2, that no one should be admitted to priestly orders without a benefice; 3, to provide against vicious or ignorant incumbents; 4, to legislate upon the validity or nullity of clandestine marriages; 5, to remedy the abuse of quæstors, or distributors of indulgences. The first question, that of residence, gave rise to warm discussions, and was at length adjourned to a later period. With regard to the question of ordination, it was decreed by the Council that no one should be ordained without being provided with either a living, patrimony, or pension sufficient for his maintenance as a priest; such a living, patrimony, or pension not to be resigned, alienated, or taken away without leave from the bishop. Bishops were empowered at the same time to unite poor livings into one, and to oblige the parishioners to repair the parish churches. It was decreed also that the conferring of clerical orders, the testimonials, seal, &c., should be gratuitous on the part of the bishop and his court, and the notary fees were fixed at a very low rate. With regard to those incumbents who proved unequal to their ministry, if through ignorance or infirmity, the bishop was to give them proper coadjutors; and if through misconduct, he was, after trying admonition first, to administer condign punishment. As many lay persons were possessed of benefices, the Council decreed that every holder of a benefice in a cathedral or collegiate church should be obliged to take the order corresponding to his ministry, and that no one could vote in the chapter unless he were a subdeacon; that no one should be ordained bishop unless he had been at least six months in holy orders, and was a doctor of divinity, or had testimonials from some university, or, if a monk, from the superiors of his order, of being qualified to expound theology and canon law.

Dispensations used frequently to be obtained from Rome on false pretences. It was decreed that all dispensations should be examined by the respective ordinaries, who were to ascertain the truth of the ground on which they were granted. Bishops were likewise enjoined to look to and watch strictly the proper administration of charitable funds and pious bequests; and in particular instances they were to act as executors. Notaries were subjected to examinations in all such matters. The pain of excommunication was pronounced *ipso facto* against every one, without any distinction of persons, who should usurp or detain any property, right, or emolument belonging to any church, benefice, Mont de Piété, or other pious and charitable establishment, until he should make full restoration and receive absolution from the pope. This gave rise to serious objections, especially on the part of the French parliaments, who asserted that the Council had exceeded its powers, and had encroached upon the rights of the civil authority.

The subject of the quæstors, or deputed distributors of indulgences and receivers of the alms of the faithful to be applied to pious purposes, came next before the Council. It was owing to some of these men that the great schism of Germany and Switzerland had originated. The abuse was notorious, and a remedy was necessary for the honour and the very existence of the church. Many fathers of the Council were for abolishing altogether the office of quæstor, as a source of unavoidable corruption; others were for circumscribing it by giving to each quæstor an adjunct appointed by the ordinary, who was to derive no profit whatever from the sale. It was represented that former Councils, such as that of Vienne and Lyon, had acknowledged the abuses of the quæstorship, and had restrained them by enactments. While the fathers were debating, the bishop of Lanciano arrived at Trent from Rome with communications to the legates that it was the pope's wish that the office of quæstor should be entirely suppressed. The decree of abolition was then carried unanimously, reserving to the ordinaries or chapters the faculty of publishing at due seasons the indulgences of the church, without any remuneration, and to receive the voluntary oblations of the faithful and apply them to charitable purposes. This measure of reform was one of the most effective which were carried in the Council of Trent.

Meantime the Committee of the Council appointed to examine matters of dogma and ceremony, proposed several questions concerning the use of the communion and the mass. The court of France and the emperor wished the use of the cup to be granted to the laity, in order to remove at least one of the points of contention with the Protestants; the envoy of the duke of Bavaria suggested moreover the expediency of allowing marriage to priests. Upon which Cardinal Sforza Pallavicino, the orthodox historian of the Council, exclaims with an expression of wonder that it appeared as if Catholic princes fancied that the Council was assembled for the purpose of pleasing rather than condemning heretics! After much discussion the Council decreed that laymen and non-officiating churchmen were not obliged to communicate under both forms; and in reply to those who wished to take the sacrament in both, it was decided that the question should be referred to the Roman pontiff, who would settle it for the best advantage of the Christian world.

On the subject of the Episcopal institution, a grave question arose which threatened a schism in the assembly. It was, whether the bishops held their ordination by divine institution, or whether they held their faculty from the pope as Vicar of Christ. The archbishop of Granada as the head of the Spanish bishops maintained the first doctrine, namely, that a bishop held his see by divine right, whilst most of the Italian bishops and the generals of monastic orders asserted that although the Episcopal character was indelible, the jurisdiction of a bishop over any particular diocese was liable to change at the will of the Roman pontiff. Lainez, general of the Jesuits, spoke at great length on the subject. He asserted that the Episcopal order or character is distinct from the Episcopal jurisdiction; the first, being from God, is imparted at the moment of consecration, while the second is held by the bishop's commission from the pope, who is the Vicar of Christ, and the first source of all ecclesiastical authority upon earth, and who can bestow the same jurisdiction upon any other clergyman. This doctrine of Lainez met with much opposition, especially from the Spanish prelates, who said that the Jesuit wanted to extend the authority of the pope at the expense of that of the bishops. The settlement of the canon upon this question was deferred till after the arrival of the Cardinal de Lorraine, a learned canonist and a most influential person at the court of France, who was anxiously expected at Trent. He arrived about the middle of November, accompanied by fourteen French bishops, three abbots, and eighteen doctors of divinity, mostly from the Sorbonne. He was received by the papal legates and the other prelates with marks of the greatest respect. After the first introduction and congratulations, the cardinal made known that his instructions from King Charles IX and the queen-mother, Catherine de' Medici, were to ask of the Council, 1, That the use of the cup in the communion should be granted to the laity all over the kingdom of France. 2, That the sacraments should be administered in the French language. 3, That in the parish churches prayers should be said in French, and the catechism be taught in the same language. 4, That the psalms should be likewise sung in French upon a version approved by the bishops and the universities. 5, That some means be found to prevent the licentious life of many churchmen, and that if no other could be agreed upon, at least it be enacted that holy orders be conferred only upon persons of mature age. 6, That moreover if any proposals should be started in the Council, for the love of peace and the restoration of the unity of the church, to make some concessions to the seceders from its bosom in those matters which did not interfere with the word of God, such for instance as the marriage of priests or the alienation of the church property which was already in the hands of the Protestants: in all such matters the ambassadors of the French king and French bishops were instructed always to exert themselves in favour of concession. And if such concessions should be granted by the Council for the recovery of so many noble provinces which had been torn from the body of the church, the king and the queen-mother promised in their name, as well as in the name of the other princes of the royal blood, that they would accept the decrees of the Council and oblige all their subjects to conform to them. Beside these, the French ambassadors were also instructed to petition the Council against pluralities and non-residence, against benefices without duties, against the abuse of exacting fees for the administration of sacraments and other spiritual assistance, against the practice of resigning benefices or sees in favour of particular individuals; and to request also that no first-fruits and tenths be exacted upon benefices, in short, that a complete reform should be made in the temporalities of the church, so as to remove everything that savoured of avarice or simony, or other interested practices; and lastly, to urge upon the assembled fathers the necessity of defining clearly and explaining to the people the pure doctrine of the church concerning the use of images, relics, and indulgences, and the practice of pilgrimages and of pious fraternities.

All these matters, being ranged under thirty-four heads, were laid before the Council at the beginning of the year 1563, by Renaud Ferrier, president of the parliament of Paris, and orator to the Council, as petitions on the part of the French king. Both Ferrier and the cardinal of Lorraine supported them in eloquent but general terms, insisting upon the absolute necessity of a thorough reform, and of restoring the church to its antient purity, depicting with vivid colours the fearful calamities, the civil and religious wars, the bloodshed, disorders, and anarchy which distracted a great part of the fair kingdom of France, owing to the protracted schism. The tone and the particulars of these remonstrances agreed in general with those of the envoys of the emperor; but they were opposed by the Italian prelates, who thought that most of the petitions were derogatory from the authority and dignity of the Roman see. Parties ran high, and reproaches and recriminations were exchanged with acrimony. The papal legates, especially the Cardinal Gonzaga of Mantua and Cardinal Seripando, endeavoured to smooth down contention and to conciliate hostility. On the question of residence being again agitated in the Council, it was urged by the Spanish prelates that the bishops were bound to reside in their dioceses 'by divine law,' and the Cardinal of Lorraine and the other French prelates seemed disposed to agree with them. This was treading upon the old ground of dispute concerning the divine institution of bishops, and the papal legates wished to avoid the controversy. Long and animated discussions followed, projects and counterprojects of a decree were proposed, and it was not till July that the Council came to a resolution. During the debates the legates having said that the pope had authority to govern the universal church, the orators of the French king, Lansac and the president Ferrier, objected to this, as being contrary to their opinion and that of the church of France, that the Council was above the pope, an opinion which Ferrier supported by quoting the Council of Constance. Upon this Cardinal Seripando observed to Ferrier that the case was not in point, as at the time of the Council of Constance there was schism among various pretenders to the papacy, and no certain undisputed pope, and that therefore it was required for the council to assert its supremacy, in order to act as umpire; whilst now there was a legitimate undisputed pontiff, who could never allow his supremacy to be disputed, and that they, the legates, were ready to defend his supreme authority as the representative of Christ on earth even with their lives. The Cardinal of Lorraine, alarmed at the progress of the Huguenots, as they were called, in France, and at the murder of his brother the duke of Guise, became anxious to bring to a conclusion the business of the Council and return to court, and he therefore drew nearer to the legates and separated himself from Ferrier and the other envoys of the Sorbonne or Gallican school.

In the month of March (1563) the two most distinguished of the Papal legates at the council, Cardinals Ercole Gonzaga and Girolamo Seripando, died at a short interval from each other. Their loss was greatly felt, for they were both learned, temperate, conscientious, and irreproachable. Pope Pius IV. substituted for them Cardinals Morone and Navagero, and appointed Morone to be president of the council.

In July of that year the Council issued its canon on the subject of residence. Without entering into the question of divine right, it enjoined all bishops, archbishops, and cardinals having the charge of a see or cathedral church, to reside personally in their respective cathedrals throughout the year, and more especially during the Lent, Advent, Christmas, Easter, and other solemn festivals, except in cases of urgent necessity, through motives of Christian charity, or 'for the evident advantage of the church or commonwealth,' and then not without the written approbation of the pope or of the metropolitan. The same decree was extended to incumbents of parishes.

The Council issued a canon concerning the doctrine of the institution of bishops. It stated that there is a hierarchy in the church, instituted by divine ordination, and consisting of bishops and presbyters and other ministers; that bishops are superior to presbyters, and have the power of ordaining and confirming, which is not given to the others; that the only legitimate bishops are those ordained by the pope or by other ecclesiastical and canonical authority, which last expression alluded to a custom that prevailed in Germany, where some metropolitans appointed their suffragans without an express commission from the pope. At the same time a decree of discipline was annexed to the canon of doctrine. After several provisions for the proper administration of the churches, it was decreed that in every episcopal church there should be at least one seminary for the education of candidates for holy orders, and regulations were laid down for the economy, discipline, method of instruction, and the choice of teachers of such establishments. This was another very beneficial enactment of the Council.

The Council next laid down the doctrine of the Catholic church concerning marriage, which it reckons as one of the sacraments. Among other articles on this subject, it condemns polygamy as contrary to divine law, it forbids persons in holy orders contracting marriage, and it states marriage to be indissoluble, even after the adultery of one or both of the parties.

On the important question of clandestine marriages, that is to say, marriages contracted before witnesses without the intervention of the parish priest, the Council decreed that in future no marriage should be considered valid which was not contracted before the parish incumbent or before another clergyman duly deputed by the incumbent, or by the ordinary, and in presence of at least two witnesses besides, and that their names, as well as the names of the married parties, and the date of the celebration of the marriage, should be entered into a register to be kept by every parish incumbent. The Council explained also what were the cases of relationship and other canonical impediments to the contracting of marriages, and although it did not condemn altogether the practice of dispensations being granted by the pope in particular instances, it recommended that such dispensations should be granted rarely, gratuitously, and on proper and sufficient grounds.

Hitherto the secular princes had insisted upon reforms of the church and clergy; now the pope and court of Rome urged the Council to make reforms affecting the princes and their courts. According to instructions received from Cardinal Borromeo, the pope's minister at Rome, the legates laid before the assembly several motions, chiefly in support of the ecclesiastical immunities. The following were among the principal heads:—That churchmen should not be summoned before the lay courts. That the lay courts and magistrates should not interfere in causes of matrimony, heresy, tithes, patronage, patrimonial benefices, ecclesiastical fiefs, the temporal jurisdiction of churches, nor in any cause, civil, criminal, or mixed, pertaining to the ecclesiastical courts. That churchmen should not be liable to pay taxes, tenths, forage, or subsidies of any sort, either on the property of the church or on their own patrimonial property. That the property of the church, moveable and immoveable, of every sort tithes and other rights, should be held as sacred from the hands of the lay powers. That all letters, citations, sentences, and excommunications, from the ecclesiastical courts, or from Rome, should be promulgated and executed without requiring any exequatur or permission from the civil power. That neither emperor nor king nor any other prince should interfere with the said courts or with the tribunal of the Inquisition, but should, when required, give them the assistance of the secular arm.

The above demands put forth by the legates raised a storm on the head of the Council. The emperor Ferdinand wrote, that he would never submit to have his jurisdiction curtailed either by laymen or churchmen. The French envoys went much further. Ferrier appeared before the Council on the 22nd of September, and in the name of King Charles IX. solemnly protested against what he called an attempt to infringe upon the usages and liberties of the Gallican Church, and the antient prerogatives of the most Christian king. He added, that these liberties and prerogatives had existed for ages previous to the first publication of the canon law, that they were founded upon holy writ, the antient councils, the laws of the early Christian emperors, and the custom of the kingdom. He then launched into a violent invective against the corruptions and ambition of churchmen, exhorting the fathers to begin by reforming themselves, and to imitate the example of Ambrose, Augustin, and Chrysostom, who had fought and conquered heresy, not by worldly arms, but by prayer and exhortation, by sound preaching, and by the good example of their own lives. Ferrier, having concluded his speech, was desired by the president to retire, when many of the fathers strongly condemned the language of the French envoy. Ferrier printed his own speech, adding an apology to it; an anonymous divine wrote against Ferrier, condemning, among other things, as heretical, his saying that kings derived their power from God, and not through his vicar on earth. The Cardinal of Lorraine, who was absent, having gone to Rome, also disapproved of Ferrier's language when he heard of it. The pope however wrote to the legates, recommending moderation and conciliation, and censuring the too vehement zeal exhibited in the dispute with Ferrier. But Ferrier, having taken offence at some strong expressions of the legates, and of De Grassi, bishop of Montefiascone, had already left Trent for Venice, where his colleagues had preceded him, and he never after returned to Trent. King Charles approved Ferrier's conduct both in protesting and in withdrawing from the Council, and the Cardinal of Lorraine was censured in France for having become, as they said, too much Italian and Romanist since his visit to Rome.

Pope Pius however directed his legates to withdraw the obnoxious motions, and to content themselves with a general admonition to all Christian princes, which was adopted by the Council, exhorting them to respect and cause to be respected the rights and immunities of the church, and the constitutions of the popes and councils in favour of ecclesiastical persons and ecclesiastical liberties. Thus another very delicate question was settled by the prudence and moderation of Pius IV. But the obnoxious principles started by his legates were revived by his successor Pius V. and promulgated by him in the famous bull 'In Cœna Domini.'

The Council now drew to its conclusion. A number of canons concerning doctrine as well as discipline were passed: other minor points were referred to the decision of the pope. The doctrine of purgatory and indulgences, and of the benefit derived to the departed souls from the prayers of the living, was confirmed. The invocation of the saints who intercede with God on behalf of men, and the veneration for their relics, were likewise adopted: the images of Christ and the saints were to be retained and venerated in the churches for the sake of those whom they represent, at the same time that no meretricious ornaments or other sensual enticement was to be mixed with the devotional practices. Severe penalties were decreed against churchmen having concubines, against simony, against pluralists of livings with cure of souls, and against duellists. Several regulations were made for the proper examination and selection of candidates to vacant sees, or to livings with cure of souls. The bishops were enjoined to make a visitation of their dioceses once every year with a modest train and retinue, and they, as well as the parish incumbent, to preach every Sunday and other solemn festivals. No one was to be appointed to a benefice with cure of souls under twenty-five years of age. Criminal charges against a bishop to be judged by the Roman pontiff. Provincial synods to meet once every three years, and diocesan synods every year. The council passed several constitutions for the strict discipline of monastic houses of both sexes, and the reform of abuses which had risen in them. It permitted at the same time the mendicant orders to acquire real property, although that was originally forbidden by the rules of their founders. Only the Capuchins and the 'Minori Osservanti' were excepted, at their own request, from this indulgence, as they declared that they would continue to live in poverty according to their original rules. A decree was passed by which all former decrees which had emanated from the Council concerning discipline and reform were to be understood 'save always the authority of the apostolic see.'

These and other canons being passed, in the beginning of December, 1563, the cardinal legate, president of the Council, asked the fathers whether it was their will that the Council should be closed, and that the legates, in the name of the assembly, should ask of the pope the confirmation of their decrees. The fathers assented, all except the Archbishop of Granada, who agreed as to the closing of the Council, but would not ask for the papal confirmation. Solemn thanksgivings to God were then sung in chorus by the whole Council; and prayers were said for Pope Pius IV., for the emperor Ferdinand, and for all other orthodox kings, princes, and republics, as well as prayers for the souls of Paul III. and Julius III., under whom the Council had held its earlier sessions, and also for the soul of the late emperor Charles V. and other departed orthodox princes, and anathemas were launched against all heretics. The acts of the Council were then authenticated by the notaries, and by the secretary of the Council, and signed by the fathers to the number of 255, namely, 4 legates and 2 other cardinals, 3 patriarchs, 25 archbishops, 168 bishops present; 39 proxies, 7 abbots and 7 generals of monastic orders. The acceptation of the ambassadors was then requested and given, except the ambassador of Philip of Spain, who by order of his king opposed the closing of the Council, and the ambassadors of France, who had left Trent in dudgeon.

Pope Pius IV., in solemn consistory, on the 26th of January, 1564, confirmed the acts of the Council by a bull countersigned by the cardinals. All the Roman Catholic states accepted the Council, and promulgated it in their states, with the exception of France, which persisted in its opposition, and in those assertions of jurisdictional independence of its church and king, which were afterwards embodied in a regular form by the assembled French clergy in 1682. Other princes opposed more or less openly certain particular decrees which interfered with the civil or political authority; and Philip of Spain himself, though a staunch Catholic, gave orders to his viceroys to suspend their execution in the kingdom of Naples and in the duchy of Milan.

The pope, who was really anxious for a reform in the morals and discipline of the clergy, ordered the bishops, not excepting those who were cardinals, to repair to their respective sees, enjoining them to watch over the execution of the decrees of the Council. 'It is owing to the Council of Trent,' observes the modern historian of Italy, whom we have mostly followed throughout this article, 'that the morals of churchmen have become better, and occasions of scandal have been removed. With regard to dogmas, that solemn assembly did little else than assert or confirm the antient doctrines acknowledged by the Western church; but with regard to the correction of abuses and the reform of morals, it effected much more than many former councils. It may be justly affirmed that if the Council could not obtain that the Protestants should return to Catholicism, it prevented at least the Catholics from becoming Protestants.' (Botta, *Storia d'Italia*, b. xi.)

Two distinguished Roman Catholic writers have written professedly the history of the Council of Trent, its proceedings and acts: one, the famous Frà Paolo Sarpi, displays at times a feeling hostile to the court of Rome; the other, Cardinal Sforza Pallavicino, on the contrary, writes in a tone of perfect submission to the Roman see. By comparing the two works, readers are enabled to come to something like a fair understanding of the labours and the merits of that memorable assembly.

(Among the numerous works relative to the proceedings of the Council of Trent, the following may be mentioned: *Universum Sacrosanctum Concilium Tridentinum Œcumenicum ac Generale*, 4to., Brixiæ, 1563; *The Canons and Decrees of the Council of Trent translated*, 4to., London, 1687; *La Harangue des Ambassadeurs du Roi de France, Charles IX., prononcée en Latin au Concile Général de Trente*, 1562, *avec la Réponse de l'Assemblée du dit Concile*, traduites par Charles Choquart, 8vo., Paris, 1562; *Oratio a Rinaldo Ferrerio, Oratore Caroli Galliarum Regis in generali Congregatione*, 23 *Nov*., 1562, 4to., Brixiæ, 1562.)

TRENT AND HUMBER, a river flowing through the central parts of England. Although the Trent and Humber are commonly spoken of as distinct, they are strictly parts of the same river. The Humber is simply the æstuary formed by the junction of several streams, and is therefore to be regarded as a part of that one of its affluents which for length and importance stands first in the system.

Basin.—If we consider the mouth of the Humber as defined by Spurn Head in Yorkshire and Donna Nook in Lincolnshire, and all the waters flowing into it within those limits as belonging to the system of which it is the outlet, the limits of its basin are as follows:—On the north-east it is bounded by the uplands, which, rising from the alluvial district of Holderness, form the cliffs which skirt with some intervals the Yorkshire coast between Spurn Head and Hornsea. Between Hornsea and Bridlington (popularly Burlington) Quay the basin extends to the coast, for the source of the river Hull is within a mile of the shore of Bridlington Bay; but its waters, instead of flowing directly into the sea, turn inland and have a circuitous course into the Humber at the town of Hull. All this part of the basin is alluvial: but near Bridlington Quay the Yorkshire 'Wolds' rise above the alluvium.

These 'wolds' consist of an insulated range of chalk hills: they belong to the great chalk range which extends from the central chalk district of Wiltshire north-east into Norfolk and Lincolnshire, although the continuity of the range is broken, first by the Wash and the ramifications of the Fen district adjacent to it; and again by the Humber and the alluvial flats which line its banks. The Yorkshire Wolds encroach upon the basin of the Humber; extending southward in the form of a crescent more than 30 miles between its extremities, from Flamborough Head near Bridlington almost to the banks of the Humber, about 8 or 9 miles above Hull; and separating the sub-basin of the Hull from that of the Derwent. Many feeders of these streams rise on the slope of the Wolds; those of the Hull in the concave, those of the Derwent on the convex side of the crescent: but the northern part of the Wolds is drained by a stream which flows through a valley in the chalk and falls into the sea at Bridlington Quay.

North-west of Flamborough Head the basin of the Humber again extends to the coast, for the source of the Hartford, a feeder of the Derwent, is as near the shore at Filey Bay as that of the Hull at Bridlington Bay, nor is the head of the Derwent itself more than two or three miles distant from Robin Hood's Bay, which is the north-eastern extremity of the basin. The oolite hills which extend from Robin Hood's Bay inland under the designation of the Eastern Moorlands, form part of the northern boundary of the basin of the Humber, which they separate from those of the Whitby Esk and the Tees. A branch of these moorlands (the Hambleton Hills and Howardian Hills), extending in a south-east direction from the western extremity of the range, divides the sub-basin of the Derwent from that of the Swale and the Ouse, all belonging to the system of the Humber.

From the western end of the Eastern Moorlands, the basin is bounded still on the north side by a lateral branch or offset of the great Pennine chain, which branch separates the basin of the Humber from those of the Tees and the Eden. The hills which constitute it rise above the valley which separates them from the Eastern Moorlands near Great Smeaton (on the great north road between North Allerton and Darlington), and extend westward, increasing in height as they proceed, by Middleton Tyas, and Barningham, to their junction with the main (Pennine chain on Arkingarth Forest near the Nine Standards Mountain at the north-western limit of the basin.

The northern part of the western boundary of the basin is formed by the Pennine Mountains, which separate it from the basins of the Eden and of the Lancashire rivers, the Lune, the Ribble, and the Mersey. The branches which the Pennine chain throws off toward the east, and which constitute the western moorlands of Yorkshire, are separated from each other by long narrow valleys, in which the Swale, the Yore, the Wharfe, the Aire, and the Calder, all directly or indirectly tributaries of the Ouse, have their course. At the southern end of the Pennine chain the western boundary is formed by the highlands of the Peak of Derbyshire and the moorlands of Northern Staffordshire, by the ridge which runs along the western border of Staffordshire, and by the hills which extend from Wolverhampton by Dudley and Hales Owen to the head of the Rea, south-west of Birmingham, between Hales Owen and Broomsgrove, where is the south-western limit of the basin. The western boundary from Staffordshire southward separates the basin of the Trent and Humber from that of the Severn.

The southern limit, commencing at the head of the Rea, runs eastward through Worcestershire and Warwickshire, past the head of the Blithe, five miles north-west of Henley-in-Arden, to Wroxhall, 4 miles north-west of Warwick; it then follows the irregular course of the high ground from Wroxhall by Meriden, Ridgelane (3 miles south of Atherstone), and Nuneaton, to Bulkington (4 miles north-east of Coventry); and turning north-east is defined by the hills which run through Leicestershire and Rutlandshire past Lutterworth, Kibworth, Billesdon, to Burleigh (two miles north-east of Oakham), the south-eastern limit of the basin. This southern boundary separates the basin of the Trent from the basin of the Severn, and from that of the Welland, one of the rivers running into the Wash.

The eastern boundary is formed by the uplands on the border of Lincolnshire and Nottinghamshire, which separate the valleys of the Witham and the Trent, passing Newark and extending to Gainsborough. As we include the waters of northern Lincolnshire in the system of the Humber, the limit of the basin must be regarded as running eastward from the neighbourhood of Gainsborough, by Market-Rasen and Louth to the sea at Donna Nook. This eastern boundary separates the basin of the Trent from those of the Glen, the Witham, and the Steeping, all flowing into the Wash.

A glance at the map will show that these limits comprehend a considerable portion of the midland and northern counties of England, including some of the most important manufacturing districts: as the great seat of the woollen manufacture in Yorkshire; of the hosiery and lace manufacture in Nottinghamshire and Leicestershire; of the cotton and silk manufacture of Derbyshire, and of the iron manufacture of Staffordshire and Warwickshire. The extent of the basin will be better understood from the following measurements:—

	Miles.
Length of the north-eastern boundary from Spurn Head to Robin Hood's Bay, measured in a straight line between its extremities .	63
Length of the northern boundary from Robin Hood's Bay to the Nine Standards Mountain on Arkingarth Forest	71
Length of the western boundary from the Nine Standards to the head of the Rea near Birmingham	143
Length of the southern boundary from the head of the Rea to Burleigh near Oakham . .	61
Length of the eastern boundary from Burleigh to the neighbourhood of Gainsborough. .	48
Length of the eastern boundary from the neighbourhood of Gainsborough to the sea at Donna Nook	42
Circumference of the basin, measured in straight lines between its salient points . . .	428

The above measurements are from Greenough's Geological Map of England and Wales. We can only attempt to give an approximation to the area of the basin. It is as follows:—

	Square Miles.
Yorkshire, about seven-ninths of the county: the deductions being for those parts on the northern and western borders, which are drained by the Tees, the Lune, the Ribble, and Mersey; and for the small basin of the Bridlington river in the chalk wolds . . .	4500

	Square Miles.
Derbyshire, except about one-tenth part on the north-western border of the county, drained by the Mersey	900
Staffordshire, except some small portions along the western border, drained by the Severn .	1000
Warwickshire, about one-third of the county, being the north-western part . . .	300
Leicestershire, except a portion on the south-eastern border, drained by the Welland. .	600
Rutlandshire, a portion on the north-western side	50
Nottinghamshire, nearly the whole . . .	800
Lincolnshire, about one-third of the county chiefly in the northern part	900
Small portions of Lancashire and Worcestershire	50
Total extent of the basin . . .	9100

It appears from this estimate that the basin of the Trent and Humber is by far the largest in Great Britain: that of the Severn and Wye [SEVERN AND WYE, vol. xxi., 305] being only 5900 square miles; and that of the Thames and Medway [THAMES, vol. xxiv., p. 279] 6600 square miles, little more than two-thirds of that of the Trent and Humber. The above estimate is founded on the statement of the areas of the several counties as given by Mr. Rickman with the Population Returns for 1831.

Course and Affluents.—The Trent rises in the hills of North Staffordshire, near the Cheshire border. It is formed by the confluence of several streams in an extensive pond or reservoir near Knipersley or Knypersley Hall, and flows south, through the Pottery district, by Hanley and Stoke-upon-Trent, to the junction of the little river Lyme (only 5 or 6 miles long) from Newcastle; and from thence through Trentham Park, where it expands into a noble pool of 80 acres. After passing through Trentham Park, the course of the river gradually bends towards the south-east, and it flows past Stone to the junction of the Sow (18 or 20 miles long), at the village of Great Haywood, close to Shugborough Park. The course of the Trent, from its source to the junction of the Sow, which falls into it on the right bank, may be estimated at 25 miles. The Sow rises on the western side of the county of Stafford near Broughton, between Eccleshall and Market Drayton, and passes Eccleshall and Stafford; it drains, with its tributaries the Meese and the Penk, part of the western side of the basin.

From the junction of the Sow the Trent flows 15 miles south-east, turning however gradually towards the east, and receiving the Blythe (24 miles long) on the left bank, to the junction of the Tame (42 miles long), which joins the Trent on the right bank a little below Alrewas; and with its feeders, the Anker, the Blythe (which is not to be confounded with the river of the same name just mentioned), and the Rea, drains the south-western part of the basin, the seat of the great iron and hardware manufacture.

From the junction of the Tame the Trent turns northward, and flows 10 miles by Burton-on-Trent to the junction of the Dove (42 miles long), which rises in the moorlands on the northern part of Staffordshire, and separates, through nearly its whole course, Staffordshire from Derbyshire; draining, with its feeders, the Manifold, the Churnet, the Peak brook, and others, the adjacent parts of both counties, and joining the Trent on the left bank.

From the junction of the Dove the Trent flows 15 or 16 miles eastward to the junction of the Derwent (60 to 65 miles long), which joins it on the left bank, and with its feeders, the Ashop, the Noe or Now, the Wye, and the Amber, drains the northern and central parts of the county of Derby. From the junction of the Derwent the Trent flows eastward 2 miles to the junction of the Soar (36 to 38 miles long), on its right bank, and from thence 3 miles farther to the junction of the Erewash (about 20 miles long), on its left bank. The Soar, with its tributaries, the Wreak and others, drains a large portion of Leicestershire, a part of Rutlandshire, and the south part of Nottinghamshire; the Erewash drains the adjacent parts of Derbyshire and Nottinghamshire, on the border of which two counties it has its course.

The course of the Trent gradually changes from an eastern to a north-eastern direction; the change commences above the junction of the Derwent, and becomes more decided near the junction of the Erewash.

From the junction of the Erewash the Trent flows [illegible] miles to the junction of the Deven or Devon (above [illegible] miles long) with the main stream of the Trent below Newark. The Lene (13 miles long), which passes the town of Nottingham, joins the Trent on the left bank about 5 miles below the junction of the Erewash, and drains a part of the centre of Nottinghamshire. The Deven, which joins the Trent on the right bank, drains the south-eastern side of Nottinghamshire and some small adjacent portions of Leicestershire and Lincolnshire.

From the junction of the Deven the Trent turns to the northward and flows by Torksey, Gainsborough, and Burton-upon-Strather, to the junction of the Ouse on its left bank, separating the counties of Lincolnshire and Nottinghamshire for the first part of its course, and afterwards separating the Isle of Axholm or Axholme [AXHOLME, ISLE OF, vol. iii., p. 181], which belongs to Lincolnshire, from the main portion of that county. Below Gainsborough a vast extent of moor or fen land extends westward into Nottinghamshire and Yorkshire, where it is known as Haxey Carr, Hatfield Chase, and Thorn Waste, or Thorn Level. From amidst these fens rises the higher ground which constituted at first the 'holm' or river island of Axel (now Haxey), corrupted from Axel-holm into Axholm or Axholme. The length of the Trent between the junction of the Deven and the Ouse is from 48 to 50 miles. The tributaries which it receives from Lincolnshire on the right bank are small. On the left bank it receives the Idle (47 miles long), which joins the Trent by an antient cut, called 'Byker's Dyke,' at West Stockwith, a little below Gainsborough. A navigable cut, called 'the new river Idle,' joins the Trent at Keadby considerably lower down. The natural channel of the Idle joined the old or natural channel of the Yorkshire Don, and the united streams flowed into the Humber just at the confluence of the Trent and the Ouse; but the various cuts made to secure the drainage of the levels have quite turned the Don and the Idle from their natural course. The Idle, with its tributaries the Maun, the Meden, the Wollen or Wallin, the Ryton, and the Torne (which last is now conducted by a cut, 'the new river Torne,' into 'the new river Idle'), drains most of the central and northern parts of Nottinghamshire and some adjacent parts of Yorkshire.

The Yorkshire rivers which form the system of the Ouse are described elsewhere. [YORKSHIRE.] It is sufficient to notice here that the length of the Ouse, measured from the source of the Swale at the head of Swaledale to the junction of the Trent, may be estimated at from 130 to 135 miles; and that from the importance of this river and its tributaries it may dispute with the Trent the pre-eminence among the rivers which flow into the Humber. The Ouse is formed by the junction of the Ure or Yore and Swale, and receives the Nidd, the Foss, the Wharfe, the Derwent, and the Aire, which last receives the Don.

From the junction of the Trent and Ouse the river (or rather æstuary, for the tide flows up both rivers above their junction) assumes the name of Humber, and takes an eastward direction. It expands in some places to the width of a mile, and below Barton Ferry acquires a permanent breadth of more than a mile. The channel is however occupied by shoals, or by the mud or sand banks which line the shore, so that the low-water channel is much narrower than a mile. A little below the town and port of Hull, the Humber turns south-east, and gradually increasing in width till it acquires, below Pattrington, a breadth of 4 or 5 miles at high-water, and 2¼ to 3 miles at low-water, enters the German Ocean at Spurn Head, where, on what would be an island, were it not connected with the mainland by a narrow causeway a mile and a half long, are two lighthouses. The projection of Spurn Head narrows the high-water channel of the river from about 6 miles to less than 4; the low-water channel is also contracted by it, but not in so great a proportion to its whole width. The length of the Humber, from the junction of the Trent and the Ouse to the sea, is about 40 or 42 miles.

The Humber receives on the left or Yorkshire bank the Hull (30 miles long), which drains part of the East Riding of Yorkshire, and joins the Humber at the town of Hull (properly Kingston-upon-Hull), to which it gives name. On the right or Lincolnshire bank it receives the Ankholm or Ancholme (30 or 32 miles long), which joins the Humber above Barton; and some other streams of smaller importance.

The whole length of the Trent and Humber is as follows:—

	Miles.
Trent.	
From its source to the junction of the Sow, S. and S.E.*	25
From the junction of the Sow to the junction of the Tame, E.S.E.	15
From the junction of the Tame to the junction of the Dove, N. and N.E.	10
From the junction of the Dove to the junction of the Derwent, E.	16
From the junction of the Derwent to the junction of the Erewash, N.E.	5
From the junction of the Erewash to the junction of the Deven, N.E.	27
From the junction of the Deven to the junction of the Ouse, N.	50
	148
Humber.	
From the junction of the Trent and Ouse to the sea, E. and S.E.	42
Total length of Trent and Humber	190

The Trent and Humber yields in length to the Severn, which is estimated at 200 miles [SEVERN, vol. xxi., p. 304], and to the Thames, which is estimated at 220 miles [THAMES, vol. xxiv., p. 280]. But with the exception of these two, no river in Great Britain can compare with it.

The feeders of the Trent and Humber are more particularly described elsewhere:—the Sow, the Blythe, and the Tame, under STAFFORDSHIRE; the Dove, the Derwent, and the Erewash, under DERBYSHIRE; the Soar, under LEICESTERSHIRE; the Deven and the Idle, under NOTTINGHAMSHIRE; the Ouse, with its tributaries, and the Hull, under YORKSHIRE; and the Ankholm, under LINCOLNSHIRE. Different portions of the Trent or Humber are also described in the same articles.

Navigation.—The navigation of the Trent commences at Burton-upon-Trent, in Staffordshire, where a cut from the Grand Trunk, or Trent and Mersey Canal, joins it, and opens a communication with the complicated canal system of the midland counties, and ultimately with the Mersey, the Severn, and the Thames. This canal follows the valley of the Trent from the junction of the little river Lyne in the Staffordshire Potteries, and it continues to follow the course of the valley below Burton, till it finally joins the Trent at Wilden Ferry, at the junction of the Derwent. Nearly midway between Burton and Wilden Ferry the Derby Canal opens into the Trent, and communicates with the town of Derby, and (by a railway) with the collieries near Belper. The river Derwent is also navigable up to Derby, but the navigation of it has been in great degree superseded by the Derby Canal. The Soar is navigable by the help of some artificial cuts beyond Leicester, and is connected with the Leicester Union Canal and the Grand Junction Canal, and so with the metropolis. The river Wreak, or the Melton Mowbray Navigation, and the Oakham Canal, connect the eastern part of Leicestershire and the little county of Rutland with the navigation of the Soar and the Trent. Nearly opposite to the outfall of the Soar, the Erewash Canal opens into the Trent. This and the Nottingham Canal (which opens into the Trent near Nottingham) convey to the Trent the produce of the coal and iron district of the valley of the Erewash, as well as the manufactures of the town of Nottingham. The Cromford Canal, which joins the Erewash and Nottingham Canals, and the Cromford and High-Peak Railway, open a communication between the Trent and the great manufacturing district of Southern Lancashire.

The Grantham Canal connects the town of Grantham and the adjacent agricultural district with the Trent, into which the canal opens just opposite to the Nottingham Canal; and the antient Foss Dyke (which probably had its origin in the Roman times) connects the Trent with the Witham, and so with the agricultural districts of central Lincolnshire. The Idle is navigable to East Retford: it joins the Trent at West Stockwith, where also the Chesterfield Canal opens into the Trent, and brings down the produce of the coal and iron works of Chesterfield and its neighbourhood. The Stainforth and Keadby Canal, which connects the Don below Doncaster with the Trent, joins that river still lower down, at Keadby tide-lock.

The navigation of the Yorkshire rivers and their connected canals is described elsewhere. [YORKSHIRE.] The navigation of the river Ankholm, which extends upward nearly to Market-Rasen; and the Louth Navigation, which commences at the town of Louth, and opens into the Humber just within Donna Nook, belong to Lincolnshire.

The value of the Trent and Humber as a means of inland communication may be estimated from the above notice, especially when taken in connection with the Yorkshire portion of this river system. The tide flows up the Trent as far as Gainsborough, to which town sea-borne vessels of 200 tons can ascend. The lowest bridge over the Trent is at Gainsborough. There was till of late years no bridge between Gainsborough and Newark, but one (a cast-iron bridge) has been erected at Dunham, on the road between Lincoln and East Retford. The whole length of the Trent navigation from Burton to the junction of the Ouse is about 100 miles; that of the Humber 42: together 142.

This important river must have been well known to the Romans, but the name of it has not been preserved by any Roman writer. Ptolemy mentions the mouth of the river Abus (Ἄβου ποτάμου ἐκβολαί), which is supposed to be the Humber. Traces of the antient names of some of its affluents may be discerned in the names of Roman towns on or near them. Thus we trace the Penk, a feeder of the Sow, in the Pennocrucium of the Itinerary of Antoninus, near Penkridge. Richard of Cirencester mentions Derventio (probably Little Chesters, near Derby), which appears to embody the antient name of the Derwent, on which it stands. It is observable that the name of the Yorkshire Derwent, which joins the Ouse, may be traced in that of another Roman town or station, Derventio, mentioned in the Antonine Itinerary. It is worthy of notice that in Richard of Cirencester's map the river on which his Derventio stands, and which must be the Derbyshire Derwent, appears to flow to the sea on what is now the Lincolnshire coast, between the Abus, or Humber, and the Wash. Possibly this may indicate that the antient line of navigation into the upper waters of the Trent and its affluents was not as now, by the Humber, and the lower part of the Trent, but by the Witham, which was navigable for sea-borne vessels up to Lindum (now Lincoln) and the Foss Dyke.

(*Ordnance Map of England;* Greenough's *Geological Map of England and Wales;* Priestley's *Map*, and *History of Navigable Rivers and Canals.*)

TRENTON. [JERSEY, NEW.]

TRENTSCHIN (*Trentsin*, or *Trenchin*) is a county in Hungary, in the circle called 'On this side of the Danube.' It is bounded on the west by Moravia, on the north by Silesia and Galicia, on the east by the county of Thurocz, and on the south by that of Neitra. The area is 1843 square miles. This county is a large and beautiful valley, bounded on one side by the Carpathian mountains, and on the other by the Freystädt mountains. The principal river is the Waag. This river is rapid, and of great advantage to the inhabitants, but often does much damage by its inundations. Situated among the Carpathians, the soil of the county is not fertile, with the exception of some tracts, but is well adapted to the breeding of cattle, especially sheep, and the mountains are accordingly covered with numerous flocks. The air is cold, in consequence of the many high mountains, but salubrious, of which the robust constitution of the inhabitants is a proof. Where the few level spots on the two banks of the Waag can be used for agriculture, the labours of the husbandman are sufficiently rewarded; and the inhabitants of the towns of Trentschin and Betzko in particular reap abundant harvests: but on the whole there is not corn enough for the home consumption. The deficiency must be supplied by importation from the adjoining counties, and by the use of potatoes, and other means. The county produces an immense quantity of fruit, especially damsons, which are dried, boiled down, and exported. There are peasants who dry 100 bushels of damsons in a year. Scarcely any wine is produced in this county; nearly one-half of the surface is covered with forests, which abound in game, especially fallow-deer, stags, and hares. No mines of any kind are worked in this county. There are very numerous mineral-springs and hot-baths. The population consists of about 210,000 Roman Catholics, 40,000 Lutherans and Calvinists, and 7000 Jews.

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* These letters denote the direction of this part of the course of the river.

TRENTSCHIN, the capital of the county of the same name, is situated in 50° N. lat. and 18° 1′ 30″ E. long., in a very fertile country on the left bank of the Waag. It is a very old town, but probably not founded by the Romans, as some suppose. On the summit of a high rock there is a fortified castle belonging to Count Illeshazy. The town consists of one street, closed by a gate at each end, and containing only 87 houses, and of two suburbs, with 3500 inhabitants. Besides the castle, which is well worth seeing, there are the following public buildings: the county-hall, the senate-house, the parish church (containing a fine monument of the Illeshazy family), the Protestant church, and the church formerly belonging to the Jesuits, and dedicated to St. Francis Xavier. It was built in 1652, by Archbishop Lippay, and, together with the college, presented to the order. It is one of the very finest buildings in Hungary. The internal fitting up cost the founder 120,000 florins. There are seven splendid altars. The walls inside are cased to the height of five feet with grey marble veined with gold. The ten Corinthian pillars of pale-red marble give the church a very striking appearance. The pavement is of black marble, and the ceiling richly gilt and adorned with fine fresco-paintings. On the abolition of the order, this church was given to the Piarists, together with the college, to which Count Illeshazy has presented a valuable cabinet of natural history.

Two leagues from Trentschin is the little village of Teplitz, belonging to Count Stephen Illeshazy, where there are celebrated hot-springs. There are seven springs, varying in temperature from 28·5° to 32° Réaumur, one of which is used solely for drinking. The liberality of Count Illeshazy, who has a palace here, deserves to be noticed; he not only gives the use of the baths gratis to both rich and poor, but keeps all the numerous buildings in good order, and pays a medical man to attend on the patients.

(Jenny, *Handbuch für Reisende in Oesterreich.*; Blumenbach, *Gemälde der Oester. Monarchie*; Thiele, *Das Konigreich Ungarn.*)

TREPAN. [TREPHINE.]

TREPANG. [HOLOTHURIA.]

TREPHINE is a kind of saw employed in surgery for the removal of a circular portion of bone. For this purpose it is used in various cases, such as diseases requiring perforation of the antrum, necrosis with loose enclosed sequestra, abscesses in bone or under bones, &c.; but especially in injuries of the head and their various consequences, for which the removal of a portion of the skull is deemed necessary.

The trephine is now commonly employed in this country instead of a somewhat similar instrument, the trepan, which was formerly used by all surgeons, and is still frequently used on the Continent. The trepan is very like the tool called a wimble, which is used by coopers for boring holes for large corks, and is worked in the same way, with a curved rotating lever under the handle; but instead of the share-like cutting edge of the wimble, the trepan has a circular saw, which, being rotated with the lever, cuts its way through the bone.

The trephine is a smaller and more simple, but, in other respects, not more convenient instrument. Its handle is like that of a gimlet, but stronger. The shaft is terminated below by a sharp steel point, called the centre-pin, which may be fixed and removed at pleasure, and which stands in the centre of the circle formed by the saw. The purpose of the centre-pin, which projects a little below the edge of the saw, is to fix the trephine before the working of the saw; and it is kept in its place till the saw has cut a groove sufficiently deep to steady it in its further working. After this the centre-pin should be removed, for it hinders the action of the saw, and (in trephining the skull) would perforate the dura mater before the saw had cut through the bone. Around the handle of the trephine, at a short distance above the part to which the centre-pin is fixed, there is attached a hollow steel cylinder, the lower margin of which is a saw. This is called the crown of the trephine, and, for various purposes, is of different sizes.

In using the trephine, the saw is made to cut through the bone, not by a series of complete rotations, such as are made by the trepan, but by rapid half-rotations alternately to the right and to the left, as in boring with an awl. In trephining the skull various cautions are necessary, according to the form of the bone to be cut through, and the nature of the parts immediately beneath it; but the most comprehensive rule is to examine frequently what progress the saw makes, and, if it have cut through one part of the circle much sooner than the rest, to apply it somewhat obliquely, taking off the pressure of its edge from that part. The most dangerous part of the operation is when the bone is nearly cut through; for it is necessary to avoid wounding the dura mater, injuries of which are often followed by severe disease. To escape these, it is advisable when a part of the circle is cut through, and but a thin plate of bone remains in the rest of its extent, to break through this by an elevator or proper forceps. And if, after using either of these instruments, sharp points of bone are left projecting from the margin of the circular aperture, these must be carefully cut or broken off.

The use of the trephine is now much more rarely required than in former times; and this, not only because, since the time of Mr. Pott, surgeons have learned that it is beneficial in few injuries of the head beyond those in which there are distinct signs of compression of the brain, but also because, in many of the cases in which it is necessary to remove portions of bone, the instrument called Hey's saw is far more convenient. This consists of a handle and a shaft, much like those of a common fork, of which the latter has fixed to its end a transverse broad plate of steel, one end of which is a straight, the other a convex saw. With this, portions of bone of almost any form and size can be cut out both more easily and more rapidly than is possible with the trephine. It is especially useful in those cases of fracture of the skull in which angles of the broken bone are depressed, and for which the trephine used to be applied chiefly for the purpose of introducing the elevator; for in these the depressed portion itself may be cut off, and the elevator may, if necessary, be introduced at the aperture which is thus made.

TRESCHOW, NIELS, a Danish philosophical and theological writer, was the son of a shopkeeper or tradesman at Drammen in Norway, where he was born, September 5, 1751. From his parents, who were serious and religious persons, he received a careful education, which, seconded by his natural abilities and love of reading, sufficiently prepared him for the university in his fifteenth year, when he was sent to Copenhagen to study theology. Though he did not neglect divinity, he showed a preference for philosophy, history, mathematics, and the physical sciences, in which studies he found companions in Edward Storm [STORM] and Nordal Brun, who were also natives of Norway. After spending five years at Copenhagen, he became corrector or submaster of the classical school at Drontheim; and it was there that he first took up his pen as an author. In 1780 he was appointed to succeed the celebrated Jacob Baden, as rector of the academy at Helsingör, at which time he studied Kant's writings, and explained his philosophy in a series of able papers in the 'Minerva.' Not many years afterwards (1789) he obtained the appointment to the head-mastership of the cathedral school at Christiania, which, besides being valuable for its emoluments, brought him into intercourse with many individuals distinguished not only by their wealth and station, but by their patriotism and philanthropy, and their zeal in promoting the spread of intelligence. Encouraged by them, he turned his attention to the improvement of the system of education in Denmark, but, owing to the opposition they met with in other quarters, his plans were only very partially carried into effect. In 1796 his dissertation 'De Anthropomorphismo' obtained for him the degree of doctor of theology from the university of Copenhagen, at which he was afterwards (1803) appointed professor in ordinary of philosophy, an office filled by him with honour to himself, and satisfaction and advantage to the students. In 1813 he quitted Copenhagen for Christiania, in order to accept the chair of philosophy in the new Frederick's University, an institution which he had been mainly instrumental in founding. On the union of Norway with Sweden, he was made by the new king superintendent of public instruction and church affairs, which office he held for twelve years, when he retired to a small estate in the neighbourhood of Christiania, and resided there till his death, September 22, 1833. Among his chief works are—'Morality in Connection with the State,' &c.; 'Principles of Legislation;' 'Spirit of Christianity;' 'Translation of the

Gospel of St. John;' and 'The Philosophical Testament, or God, Nature, and Revelation;' all of which were the productions of his studious retirement after relinquishing public duties in 1826.

(*Conversations Lexicon der Neuesten Zeit.*)

TRESPASS is a wrong directly done to the person, to the goods and chattels, or to the lands and tenements of any man.

To the person it may be by menace, assault, battery, or maiming. [Assault.] To either dead or live chattels, by taking them away or by injuring them. To land and tenements, by entering upon them and injuring them. Trespass is the action by which a person in the actual and exclusive possession of property is protected against the forcible interference with it by those who are not entitled to it. By this action also he may recover damages for the injury done to his possession. The nature of it will appear more distinctly by instances of the persons by and against whom the action may be brought.

The kind of possession sufficient to entitle a man to bring this action against a stranger is a mere bare possession without any proof of further title to the property, but the possession must be actual and exclusive: thus, an heir who is entitled to lands, but has never entered upou them, cannot bring this action, neither can a party disseised of his lands during his disseisin; though after he has re-entered, he may do so, and recover for injuries done before the re-entry. The possession also must be exclusive: thus, one who has only a right of common cannot bring trespass for an injury done to the common, since others have rights co-existent with his own; neither can the bare possessor of a pew in a church, since in that case the possession of the church is in the parson, and moreover every parishioner has a right to go into the church. But the bare possession, if exclusive, is sufficient without proof of any further title, and it is not necessary in the case of trespass on lands that the possession should be of the actual land itself. One who is in possession of the separate herbage and feeding of a close may maintain an action against a stranger who infringes upon his right. A tenant during the existence of his demise may maintain it against the landlord himself if he enters upon the premises except for a lawful cause, as to distrain, &c. The rule with respect to goods is the same: thus the mere possessor of goods or cattle may maintain trespass against a stranger. And he who has a limited right of possession only, may maintain it even as against the actual owner during the time while the right of possession continues in him. Thus the lessee of cattle for a year may bring trespass against the owner if he take them during the year. The same holds as to a bailee of goods: with respect to goods, possession may be said to be of two kinds, possession in fact, and possession in law, sometimes distinguished by the terms actual, and constructive possession. Either kind is sufficient to enable the possessor to maintain trespass. Constructive possession is where the property of goods has vested in a party, the mere property in the such case being construed to draw after it and invest the owner with possession also. Thus where the property in goods lying at a distance becomes vested in a man, he is held immediately, and without an actual taking of them, to have the possession as well as the property in them. And he may have an action of trespass for injury done to them. So an executor is held to have been in possession of his testator's goods from the time of his death.

To constitute trespass, the act done must be wilful, not the result of negligence, and have something of force in it, so as to be, according to the construction of the law, against the peace; and the injury must be the immediate, not the consequential result of the act. This is rendered very intelligible by the instance given (1 Strange, 636): 'If a man throw a log into the highway, and in that act it hits me, I may maintain trespass, because it is an immediate wrong: but if, as it lies there, I tumble over it, and receive an injury, I must bring an action on the case.' But it is not necessary that it should be done with the design to cause the injury complained of, it may be done in mistake or ignorance. Thus where one shooting at a mark hits a by-stander, he is guilty of trespass. A sheriff commits an act of trespass if he takes the goods or arrests the person of B, mistaking him for A. A man is liable in trespass for the injury done by his cattle to the land of another, whether he knew of their doing it or not. In trespass, all persons who assist in the act done, or cause it to be done, or, if it is for their use, assent to it afterwards, are considered as principals, although not actually present at the doing of the act. Where an act is done by a servant wilfully, and while in the discharge of his business as such servant, the master is liable for the act in trespass. But if it is wilful on the part of the servant, and not in discharge of his master's business, the master will not be liable unless by such assent as is above stated.

Where a person has an authority or licence given him *by law*, and he takes advantage of that to commit an act of trespass, he is held to have been a trespassor from the very commencement of the proceedings: as where a landlord lawfully distrains a beast and afterwards works or kills it, or an officer of the customs entitled to search 'unpacks stuffs and puts them in the dirt.' If however the licence or authority has proceeded from a private party, the trespass does not relate back, but is confined to the mere act itself: as where parties enter a tavern, drink and pay for wine, and afterwards commit a trespass—that will not make their entry a trespass. In cases where a trust is reposed, trespass will lie for an act which is at variance with the trust, as where a lessee at will cuts down the timber.

Various circumstances may exist which afford a justification for an act which otherwise would amount to trespass. Thus a man is not liable in trespass though his cattle have entered the field of another, if they have done so in consequence of the neglect of the party into whose land they enter to repair the fences between the lands of the parties; though it is no justification that the cattle have entered because the land was open to the highway. Again, a man is justified in entering upon the lands of another to retake his goods which have been carried there by the occupier of those lands; or to carry away goods bought of the occupier, to repair a watercourse granted to him, &c. He is also justified in pulling down, for the safeguard of his own, his neighbour's house which is on fire. Where an act amounts to a felony it is not competent for the party injured to treat it as a trespass. (Comyns's *Dig.*, 'Trespass.')

In the case of malicious injuries done to property by trespassors a number of provisions have been enacted by 7 and 8 Geo. IV., c. 30. In many cases a jurisdiction is given to magistrates to inflict punishment on the offenders, to award compensation to the parties injured, &c.

(Burn's *Justice*, by Chitty, tit. 'Malicious Injuries to Property.')

TRET. [Tare.]

TREVES. [Trier.]

TREVI'GI, THE PROVINCE OF, an administrative division of the Venetian States, forming part of the Lombardo-Venetian kingdom, under the emperor of Austria, is bounded on the north by the province of Belluno, on the east by the Friuli, west by the province of Vicenza, and south by the provinces of Padua and Venice. It is not so large as the former province called 'il Trevisano' under the republic of Venice, several districts of which have been annexed to the provinces of Belluno, Padua, and Venice. The actual province of Trevigi is divided into 12 districts and 204 communes, and reckons 133,000 inhabitants. Two-thirds of the province consist of a fine plain, which is one of the most fertile parts of the Venetian territory; the other third, which lies northward of the town of Treviso, is hilly. The river Piave, coming from Belluno, crosses the province of Treviso from north-west to south-east, and enters the Adriatic north of the lagoons. Farther north, in a direction nearly parallel to the Piave, flows the river Livenza. Both the Piave and the Livenza are navigable for large boats to the sea. The principal productions of the province of Treviso are corn, wine, fruit, wool, silk, cheese, and cattle. There are also manufactories of silks, woollens, and paper. Twelve miles north of Treviso, where the hills begin to rise, is an extensive forest called Montello, belonging to the crown; it supplies Venice with timber for ship-building. The principal towns of the province are—1, Treviso. 2, Bassano, a town of 12,000 inhabitants, including the suburbs, is situated on the river Brenta, has manufactories of silk and wax, and the well-known printing establishment of Remondini, some fine churches with good paintings, a gymnasium, an hospital, and a theatre. Bassano has produced many distinguished artists, among others the painter Jacopo da Ponte, and his sons, also painters, the engraver Volpato, and the engineer Ferracini. Gamba has written biographical sketches 'Dei Bassanesi Illustri.' 3, Asolo, a very old town, now decayed, contains 3000 inhabitants. It was in the castle of Asolo that Caterina Cornaro, last queen of Cyprus, was kept in a kind of honourable confinement by the Venetian senate from 1489 till her death, which occurred in 1510. 4, Castelfranco has 6000 inhabitants, a handsome collegiate church, and considerable traffic. It is the native place of the painter Giorgione. 5, Conegliano has 6000 inhabitants. 6, Ceneda is a bishop's see, and has 5000 inhabitants. 7, Oderzo, an antient but decayed town, 12 miles north-east of Treviso, has about 6000 inhabitants. 8, Porto Buffole, on the Livenza, where the river becomes navigable for large boats, about 22 miles from the sea, has 3000 inhabitants.

(Rampoldi, *Corografia dell' Italia;* Verci, *Storia della Marca Trevigiana.*)

TREVI'GI, or **TREVI'SO**, a bishop's see, and the head town of the province of the same name, is situated in a fertile plain on the banks of the river Sile, which is navigable by large boats, and communicates by means of canals with the lagoons of Venice. A small river called Botteniga flows through the town, and joins the Sile. The town is old, the streets are irregular, and mostly lined with arcades, and adorned with several fine buildings. The cathedral, built first by the Longobards, and afterwards restored, but never finished, has some paintings by Veronese, Tiziano, and Bordone, the last a native of the place, and the relics of several saints, among others of St. Liberalis, the patron of Treviso. There are several other churches worthy of notice, as well as the episcopal palace, the town-house, the palaces of the families Pola, Brescia, and others. Treviso is surrounded by walls and a ditch, and has a circumference of about three miles. It has a spacious hospital, a Monte di Pietà, a public library, a handsome theatre called Onigo, a celebrated academy or Athenæum of sciences and literature, and about 15,000 inhabitants, independently of the suburban parishes which form part of the commune of Treviso, and which contains about 6000 inhabitants. A great fair is held here in the month of October, and it lasts a fortnight.

Treviso was an important town under the Goths and the Longobards, and was then called Tarvisium. Totila, the last king of the Goths, was a native of Tarvisium. Rotaris, king of the Longobards, having destroyed the neighbouring town of Opitergium, A.D. 641, the fugitive inhabitants went to swell the population of Treviso. Under Charlemagne and his successors Treviso was the capital of a march, or border province, extending from the Alps to the Adige, and known by the name of Marca Trevisana, which afterwards, during the middle ages, became restricted to the territory between the Friuli, the Alps, the state of Padua, and the lagoons of Venice. In the 11th century Treviso became an independent municipal community, like most other towns of North Italy. It afterwards fell successively under the dominion of Ezzelino da Romano, of the Carrara of Padua, and the Della Scala of Verona, till the fourteenth century, when it came into the possession of the republic of Venice, retaining however its municipal council and magistrates, and its own statutes, and its nobility retained their fiefs and jurisdictions in the country. The political and military chief of Treviso was a patrician sent from Venice with the titles of Podestà and Capitanio. This form of administration lasted till the fall of Venice in 1797. During the war of the league of Cambrai in 1509 it was the only considerable town of the continental dominions which remained attached to Venice, sustaining a siege from the united French and Imperial armies.

The family of Ordelaffi, which ruled Forli and part of the Romagna for centuries, were originally from Treviso. Burchiellati, a citizen of Treviso, has written the history of his native town. Treviso is 18 miles north by west of Venice, and 25 miles north-north-east of Padua.

(Rampold, *Corografia dell' Italia*, *Topografia Veneta*, 1787; Rigamonti, *Pitture di Trevigi*, *Memorie delle Arti di Trevigi*, 1803.)

TREVISA'NI, FRANCESCO, CAVALIERE, an eminent Italian painter of the eighteenth century, was born at Capo d'Istria near Trieste, in 1656. He is called by the Venetians, Roman Trevisani, to distinguish him from Angelo Trevisani of Venice. Francesco acquired the first principles of design from his father Antonio Trevisani, an architect; and learnt painting of a Fleming, whose name is not mentioned, who was remarkable for his pictures of spectres, incantations, and such subjects; and young Trevisani executed a very good picture in the same style in his eleventh year. He afterwards became the scholar of Antonio Zanchi at Venice, and painted in his style for some time; he then studied the works of the great Venetian masters, and distinguished himself by several fine pictures in the Venetian manner, which he painted at Venice whilst still young. Being a man of striking personal appearance, and very accomplished in several polite arts, he went much into society, and he won the affections of a noble young Venetian lady, with whom he eloped and married, and he went with her to Rome to avoid the consequences of the resentment of her family. At Rome Trevisani was fortunate enough in finding a valuable patron in the cardinal Flavio Chigi, nephew of Pope Alexander VII., for whom he executed several works, and who procured him the title of Cavaliere from the Pope. He was much employed also by the Duke of Modena, then Spanish ambassador at the court of Rome, for whom he made several copies after celebrated pictures by Correggio, Parmegiano, and Paul Veronese. After the death of Cardinal Chigi, he was much patronized by Cardinal Ottobuoni, for whom he painted an excellent picture of the Slaughter of the Innocents. Trevisani's works are numerous in Rome; he painted also for many other cities, and for foreign countries; he executed some pictures for Peter the Great of Russia: he died in 1746, aged 90.

After his arrival in Rome he forsook the Venetian manner of painting, and adopted that which prevailed in Rome at that period, which consisted chiefly in the imitation of Guido, Domenichino, and others of the Carracci school. But Trevisani painted in many styles, and in almost every line: history in large and small figures, portraits, animals, sea pieces, landscapes, architecture, and flowers; he could imitate well a picture by any master. His best pictures are a good deal in the style of Guido; his composition is grand, and his chiar'oscuro forcible, his execution free and bold, and his drawing generally correct and graceful; but his chief excellence consisted in a purity and brilliancy of colouring. His best pictures are, a Crucifixion, in the Church of San Silvestro in Capite; a San Francesco, in the Church of San Franscesco delle Sagre Stimate; Saint Joseph dying, in the Church of the Collegio Reale; and a Prophet, in the Church of San Giovanni Laterano; and the cupola of the Cathedral of Urbino, painted for Clement XI. The Albicini family at Forlì possessed in the time of Lanzi various specimens of his different styles, amongst them a Crucifixion in which the figures were very small but elaborately painted, which Trevisani is said to have considered his best picture, and to have offered a large sum for its re-purchase.

TREVISA'NI, A'NGELO, of Venice, was an excellent portrait painter, and painted also some good historical pieces: he excelled in chiar'oscuro. There is a fine altar-piece by him in the church Della Carità at Venice. Neither the date of his birth nor death is known; accounts differ, but he was living in 1753. There are portraits of both the Trevisani in the painters' portrait gallery at Florence. (*Museo Fiorentino;* Lanzi, *Storia Pittorica;* &c.)

TREVISO. [TREVIGI.]

TREVOR, SIR JOHN, Knight, a Secretary of State in the reign of Charles II., was born in the year 1626, and was the eldest son of Sir John Trevor, Knight, of Trevallin in Denbighshire, and descended from an antient Welsh family. Anthony Wood, in recording his appointment as Secretary of State, says of him and his father that they were both 'halters in the rebellion, and adherers to the usurper.' (*Athenæ Oxonienses*, vol. iii., col. 1089.) The father had been a member of the Long Parliament, but supported the measures which led to the Restoration. After this event the son became a gentleman of the bedchamber in Charles II.'s court, and in February, 1668, was sent as special envoy to France, to carry out the object of the treaty called the Triple Alliance, viz. a peace between France and Spain. (Dalrymple's *Memoirs*, Appendix, p. 6.) He negotiated the provisional treaty, which was signed at St. Germain-en-Laye, on the 15th April, 1668, and which received its full confirmation and development in the treaty of Aix-la-Chapelle, May 2, 1688. [AIX-LA-CHAPELLE; TRIPLE ALLIANCE.] After his return to England he was knighted, and in September appointed secretary of state in the room of Sir W. Morrice. He obtained this appointment through the influence of the duke of Buckingham, who had then ttained to the chief favour with the king. (Pepys's *Diary*, ol. iv., p. 166.)

Two different stories have been transmitted as to the node in which Trevor's appointment was brought about; ut both equally illustrate the custom of the time. Sir Villiam Temple writes to Lord Arlington, 'They will ave it that the king lays down eight thousand pounds to ring this about, which is a good bargain both for him that omes in and him that goes off.' (*Temple's Letters to the arl of Arlington and Sir John Trevor, &c.*, published by . Jones, Gent., 1699, p. 10.) Pepys however had an nformant, 'who for news tells me for certain that Trevor o come to be secretary at Michaelmas, and that Morrice oes out, and he believes without any compensation.' Pepys's *Diary*.)

Sir John Trevor continued secretary of state until his eath in 1672. It was his merit, during the time that he eld office, to oppose the French policy which Charles was en pursuing at the instigation of the Duke of York, and ith the zealous co-operation of Lord Arlington, the other ecretary of state; and to endeavour to moderate the perecution of Protestant nonconformists, which was carried n during that period, under the same advisers, by means the Conventicle Acts. Having been originally one of the abinet, he was put out of it in consequence of his oppotion to the Duke of York's policy in 1670. 'It was rearked,' says Mr. Hume, 'that the committee of council stablished for foreign affairs was entirely changed; and at prince Rupert, the Duke of Ormond, secretary Trevor, nd lord keeper Bridgeman, men in whose honour the ation had great confidence, were never called to any eliberations.' (*History of England*, vol. vii., p. 458, ed. 791.) Sir William Temple, who returned to England from e Hague in 1670, and grieved to see the rapid progress a policy directly contrary to that of the Triple Alliance hich he had achieved, found Trevor of the same opinion ith himself, but unable to do anything, as he was, in r W. Temple's phrase, 'merely in the skirts of business.' *emple's Works*, vol. ii., p. 170.)

Sir John Trevor died, after a short illness, on the 28th of ay, 1672. He died a year before his father, who, when died, was succeeded in his estates by Sir John Trevor's dest son. Sir John Trevor had married Ruth, one of e daughters of the celebrated John Hampden, by hom he left a numerous family. His second son, homas, was bred to the law, and having pursued it ith great success, attained to political as well as legal ninence. He was in William III.'s reign successively licitor and attorney-general, and in 1701 was appointed ief-justice of the Common Pleas. He was created a peer y Queen Anne, in 1711, by the title of Lord Trevor of romham, in Bedfordshire. In 1726 he was made lord rivy seal by George I., and in 1730, but a month before s death, received from George II. the post of president of e council. He died on the 19th June, 1730. His chacter is briefly sketched by Speaker Onslow in a note on urnet (vol. iv., p. 334, ed. 1823), where he is described as ving the general esteem of all political parties, though, eginning as a Whig, he after a time left the party, and en again rejoined it; and as an able and upright, but served, grave, and austere judge.

The third son of this Lord Trevor ultimately inherited s title, being the fourth Lord Trevor. He was a distinuished diplomatist, and having published a volume of oems, is enrolled in Horace Walpole's list of 'Royal and oble Authors.' Having had the Hampden estates left him by his cousin, John Hampden, Esq., who was like imself great-grandson to the patriot Hampden, and who ied unmarried, he took the name and arms of Hampden, nd was in 1766 created Viscount Hampden. (Collins's *eerage*, by Brydges, vol. vi., pp. 291-304.)

TREVOR, SIR JOHN, Knight, a lawyer of eminence, nd speaker of the House of Commons in the reigns of ames II., and William and Mary, was a member of the ame Welsh family as the subject of the previous article, nd the second son, but ultimately heir, of John Trevor, Esq., of Brynkinalt, in Denbighshire. By his mother, he was first cousin to the notorious Judge Jefferies. He was orn in 1633.

The history of this Sir John Trevor has been sketched by the strong pen of Roger North, in a well-known passage in his 'Life of the Lord Keeper Guilford' (vol. ii., p. 27): 'He was a countryman of the lord chief justice Jefferies, and his favourite. . . . . .He was bred a sort of clerk in old Arthur Trevor's chamber, an eminent and worthy professor of the law in the Inner Temple. A gentleman that visited Mr. Arthur Trevor, at his going out, observed a strange-looking boy in his clerk's seat (for no person ever had a worse sort of squint than he had), and asked who that youth was? "A kinsman of mine," said Arthur Trevor, "that I have allowed to sit here, to learn the knavish part of the law." This John Trevor grew up, and took in with the gamesters, among whom he was a great proficient; and being well grounded in the law, proved a critic in resolving gaming cases, and doubts, and had the authority of a judge amongst them; and his sentence for the most part carried the cause. From this exercise he was recommended by Jefferies to be of the king's council, and then master of the rolls, and, like a true gamester, he fell to the good work of supplanting his patron and friend; and had certainly done it if king James's affairs had stood right up much longer; for he was advanced so far with him as to vilify and scold with him publicly in Whitehall.' Having been solicitor-general in the reign of Charles II., Sir John Trevor was appointed master of the rolls by James II. in 1685, and on the meeting of parliament in May of that year he was elected speaker of the house of commons. In the beginning of 1688 he was made a privy councillor. After the Revolution Trevor obtained the confidence of William III., and was much consulted by him. There is a paper of his, addressed to William, published by Sir John Dalrymple (*Appendix*, part ii., p. 80), in which he counselled the dissolution of the Convention parliament. This parliament having been dissolved, and a new one assembled on the 20th of March, 1690, Sir John Trevor was a second time elected speaker. He was also appointed one of the commissioners of the great seal. 'The speaker of the House of Commons, Sir John Trevor,' says Burnet, 'was a bold and dexterous man, and knew the most effectual ways of recommending himself to every government: he had been in great favour in king James's time, and was made master of the rolls by him; and if Lord Jefferies had stuck at anything, he was looked on as the man likeliest to have the great seal. He now got himself to be chosen speaker, and was made first commissioner of the great seal; being a Tory in principle, he undertook to manage that party, provided he was furnished with such sums of money as might purchase some votes; and by him began the practice of buying off men, in which hitherto the king had kept to stricter rules.' (*History of his Own Time*, vol. iv., p. 74, ed. 1823.)

In the session of 1695 the corrupter of others was discovered to have been himself corrupted, and was expelled from the speakership and from the house. It was proved that he had received a bribe of a thousand guineas from the city of London for his support of a bill in which the city was greatly interested. (Burnet, vol. iv., p. 254.) Being speaker, he had to put the question for his own expulsion. 'He sat above six hours,' says North, 'as prolocutor in an assembly that passed that time with calling him all to nought to his face; and at length he was forced, or yielded, to put the question upon himself, as in the form, "As many as are of opinion that Sir John Trevor is guilty of corrupt bribery by receiving, &c.;" and in declaring the sense of the house declared himself guilty. The house rose, and he went his way, and came there no more.' (*Life of the Lord Keeper Guilford*, vol. ii., p. 28.)

Sir John Trevor, though thus expelled from the House of Commons, retained the mastership of the rolls, 'to the great encouragement,' as North remarks, 'of prudent bribery for ever after.' He had the character of being a man of great talents, though of no principle. There are some anecdotes of him in Noble's 'Continuation of Granger's Biographical History' (vol. i., p. 172), which show him to have been extremely mean and avaricious. He died on the 20th of May, 1717, in London, at his house in Clement's Lane, and was buried in the Rolls' chapel.

His only daughter married Michael Hill, Esq., a privy councillor and member of parliament, and had two sons. The eldest son was created Viscount Hillsborough, and his son Marquis of Downshire. The second son, succeeding to his grandfather Sir John Trevor's estates, took the name and arms of Trevor, and was created, in 1766, Viscount Dungannon.

TREW, CHRISTOPHER JAMES, a celebrated anatomist and botanist, was born at Lauffen, a small town in

Franconia, near Nürnberg, on the 26th of April, 1695. His father, who was an apothecary, took charge of his education and taught him the principles of botany and pharmacy. Trew went in 1611 to Altdorf in order to attend the lectures of the faculty of medicine, and was admitted to the degree of doctor in 1716, after five years' study. On his return to his own country he immediately began to practise, and obtained sufficient support to encourage him to continue. He however soon formed the resolution of travelling; and accordingly he went through Germany, Switzerland, France, and Holland, and stayed for a year at Danzig. In 1720 he returned to Lauffen, and became a member of the College of Physicians at Nürnberg. The extensive practice that he soon succeeded in obtaining made him so well known to the world, that the margrave of Anspach granted him the title of physician-in-ordinary and counsellor to the court (Hofrath). He was admitted in 1742 as a member of the 'Académie des Curieux de la Nature,' and was raised in 1746 to the dignity of president, which at this time included the titles of count palatine, aulic counsellor, and physician to the emperor. He died on the 18th of June, 1769, at the age of seventy-four, without ever having been persuaded to leave Nürnberg, notwithstanding the attractive offers that were made to draw him to Altdorf and elsewhere. Assisted by the excellent painter Ehret, he published the beginning of a magnificent work on botany, which was continued after his death by Vogel. With regard to anatomy he conjectured that the mesaraic veins possessed the faculty of absorption; he proved that the pretended salivary ducts of Coschwitz are simple veins; and he very well demonstrated the differences which are observed in the human body before and after birth with regard to the organs of circulation. Besides one hundred and thirty-three observations which are to be met with in the 'Commercium Litterarium' of Nürnberg, and one hundred and thirty-seven which have been inserted in the 'Acta Curiosorum Naturæ,' the following are his principal works in anatomy and botany. In the former science he published 'Dissertatio Epistolica, de Differentiis quibusdam inter Hominem natum et nascendum intercedentibus deque Vestigiis Divini Numinis inde colligendis,' Nürnberg, 1736, 4to., with a great number of plates representing peculiarities of the fœtus; 'Epistola ad Alb. Hallerum de Vasis Linguae salivalibus atque sanguiferis,' Nürnberg, 1734, 4to.; 'Tabulæ Osteologicæ Corporis Humani,' folio, max., fine coloured plates, Nürnberg, 1767. In botany his first publication was the description of a flowering American aloe, Nürnberg, 1727, 4to. In 1750 he began to publish one of the most splendid botanical works that has ever appeared, under the title of 'Plantæ selectæ quarum Imagines ad Exemplaria Naturalia manu pinxit G. Dionysius Ehret, Nominibus Propriis et Notis illustravit, C. J. Trew,' Nürnberg, folio. To the incomparable designs of Ehret, Trew added descriptions and remarks, and the work appeared in decades, of which seven were completed. In the same year he commenced a similar publication of garden-flowers, entitled 'Amoenissimæ Florum Imagines,' which was carried on to six decades. In 1757 he published 'Cedrorum Libani Historia et Character Botanicus, cum illo Laricis, Abietis, Pinique comparatus,' Nürnberg, 4to., with plates by Ehret; the second part appeared ten years afterwards. He also published a much improved edition of Blackwell's 'Herbal,' in English and German, with an appendix of new plants. Having made the acquisition of the wooden plates left by Gesner, he gave an impression of two hundred and sixteen figures of plants from them, under the title of 'Icones posthumæ Gesnerianæ,' 1748.

(*Biographie Médicale.*)

TREWCA'CEÆ, a natural order of plants belonging to the rectembryose group of incomplete Exogens. This order has for its type a single genus, Trewia, which was named after Christopher James Trew, a physician of Nürnberg. The species are but few: they are trees with opposite and stipulate entire leaves and diœceous flowers: the antheriferous flowers are arranged in long racemes, and the pistilliferous flowers are axillary and solitary. The calyx in both flowers is 3-4-cleft; the stamens are numerous; the style is 4-cleft; the fruit is a drupe, 4-celled, with one seed in each cell.

The plants of this order are natives of tropical India, and their properties are at present unknown, nor is their structure well understood. As far as has been at present examined, they resemble Urticacea, but still differ sufficiently to justify their removal from that family. Hence Lindley has constituted an order of the genus Trewia.

TRIADS. [WELSH LANGUAGE AND LITERATURE.]

TRIAL, the means adopted for the purpose of ascertaining facts in issue in common law proceedings whether civil or criminal. The equity courts have also the power where they think it convenient, in the case of disputed facts, of directing an issue to be tried at common law.

The kinds of trial in civil cases were formerly seven in number, according to Blackstone; and those which he enumerates are, by record, by inspection or examination (divided into two distinct kinds by Comyns), by certificate, by witnesses, by wager of battle, by wager of law, and by jury.

In reality the six first might more properly be called modes of proof rather than kinds of trial, which in truth divide themselves into two classes only: 1, That where the court itself decides upon the evidence without the intervention of a jury; 2, That where the jury decides.

The first class contains the first six enumerated by Blackstone; that *by record* is where the existence of a certain record has been alleged in the pleadings of an action, and is denied by the pleadings on the other side. The existence of it must be proved by the record itself. The court itself tries this issue, and decides accordingly as such record is, or is not produced. [RECORD; RECORDS.]

Questions whether or not a party is a peer are thus proveable by the king's patent; whether an alien is friend or enemy, by production of the treaty between his country and Great Britain, &c.

By inspection was where it was supposed a matter might be clearly made manifest on view to the court. In error by an infant, to reverse a fine, if issue was taken as to his nonage, he might be brought into court and there inspected for the purpose of ascertaining the fact. If on appearance it remained doubtful, the court might question him, or examine those likely to be informed. So when a defendant pleaded in abatement that the plantiff was dead, and some one appeared and said that he was the plaintiff, &c. The court had at all times the power, if they [illegible] doubt, to order a trial by jury. This mode of proceeding has now become obsolete.

By *examination* is upon inquiry by the court into, [illegible] instance, the customs and usages of a court.

By *certificate*. By certificate is where a fact is proved by the production of a certificate from a certain official person qualified to grant such certificate. Thus formerly the absence of a person from England during war might be tried by the court, and proved by a certificate of the 'mareshal of the king's host.' In the same manner the customs of the city of London are proved by the certificate of their recorder. A certificate of a bishop is proof respecting matters of ecclesiastical jurisdiction, &c.

By *witnesses*. In action of dower where the tenant pleads that the husband is alive, the court may inquire into the fact by witnesses called before themselves. Lord Coke mentions several other cases where the court itself decides upon the examination of witnesses; and he further states that in all such cases each fact must be proved by two witnesses at least. Although in the case of a trial by jury one witness, according to the English law, is sufficient.

By *wager of battle*. That is by single combat between the champions of the parties. This seems to have been a mode of ascertaining a disputed fact prevailing among the antient Germans, and is said to have been introduced into England by William the Conqueror. It was employed when issue was joined in a writ of right. The combat took place at sunrise in a piece of ground sixty feet square, enclosed for the purpose, and in the presence of the judges of the court of Common Pleas dressed in their scarlet robes. The weapons used were staves and targets; the champions were dressed in armour, but bare-headed, and with their arms and legs bare, with red sandals on their feet. The battle might be continued till the stars appeared. If this was done, the party in possession of the land was held entitled to retain it; if not, the court pronounced judgment in favour of the party whose champion was successful. All this proceeding was abolished by 59 Geo. III., c. 46.

The proof by *wager of law* was employed in an action of debt upon simple contract, of detinue, account, and some others. It was effected by the defendant coming into ourt attended by eleven of his neighbours who were called ompurgators. He then solemnly swore that he did not we the sum with which he was sought to be charged, or etain the thing sought to be recovered, and the eleven ompurgators swore that they believed him. The wager f law had already fallen into disuse when it was wholly bolished by 3 & 4 W. IV., c. 42.

The mode of trial always the one most in use both in ivil and criminal matters, was the trial by jury. [Jury.]

In criminal cases recourse was antiently had to the rdeal for the purpose of ascertaining the guilt or innocence f a party [Ordeal], and also to the single combat Appeal]. It appears doubtful whether the ordeal fell into isuse, or was abolished by statute. Appeals in criminal ases were done away with by 59 Geo. III., c. 46.

A peer of Great Britain indicted capitally is entitled to e tried by the peers of parliament assembled in the court f the Lord High Steward of Great Britain, who is a peer ominated to that office by the crown for the occasion. he proceedings of the trial are carried on in the same ay as on a trial by jury, and judgment is pronounced acording to the opinion of the majority, which must consist f at least twelve. Cases of impeachment by the Commons re also tried by the Lords.

A trial at bar resembles the ordinary cases of trials by ry, except that instead of its being presided over by a ngle judge, all the judges of the court in which the action brought are in attendance. It is granted on application o the court, but only in cases of great difficulty and imortance. In informations exhibited by the attorney-geneal, as law-officer of the crown, he is entitled to a trial at bar.

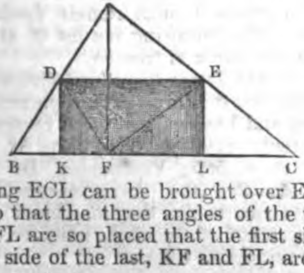
New Trial. After a trial has been already had, it is ompetent to the court in which the action is brought to rant a new trial on an application made, and grounds hown for supposing that justice has not been done between he parties; and that the case is of sufficient importance to arrant such a further expense. These grounds are various, uch as a misdirection by the judge, a verdict against evience, excessive damages, &c.

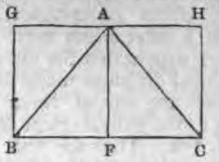
(Comyns, *Dig.*, tit. 'Trial;' Blackstone, *Com.*)

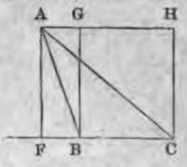
TRIANGLE, a figure having three angles, and conseuently three sides: this consequence is usually made the efinition; and the same thing occurs in Euclid, whose ord is *τρίγωνον* in the Elements, though it is *τρίπλευρον* n the definitions prefixed.

A triangle may be drawn upon any surface, and having ny sort of lines for its sides: but it is not usual to conider any except *plane* triangles drawn on a plane with ight-lined sides, and *spherical* triangles drawn on a sphere ith arcs of great circles for the sides. The Spherical riangle has been already considered; and the formulæ onnected with the plane triangle have been given in Menuration. There is much connected with this article in Angle, Parallel, Similar, Translation, Transversal to the latter look for the reference from Menelaus to his article), Trigonometry, &c., so that we have no need o make this article of a length proportioned to the imortance of its subject in geometry. In fact, triangles are s much the elements of all figures as the letters are of ords, being the figures of the smallest possible number f sides, and into which all figures can be divided.

The two most important properties of the triangle are, hat the sum of its angles is always two right angles, and hat the area is half that of a rectangle of the same base nd altitude. Both of these propositions admit of such ractical verification as would make them perfectly intelligible to those who do not understand geometry. Take he greatest angle BAC of a triangle cut out in paper, and old the paper so that A may rest on BC at F, the part ADE folding over DFE. Then it will be found that by further folding ECL can be brought over EFL, and BDK over FDK, so that the three angles of the triangle KFD, DFE, and EFL are so placed that the first side of the first and the last side of the last, KF and FL, are in the same straight line, and the three make up the two right angles KFA, AFL. Again, the triangle BAC is either the sum or difference of the two right-angled triangles FAC, FAB, which are the halves of the rectangles FACH, FABG, the sum or difference of which is the rectangle BGHC: whence the triangle is the half of the rectangle BGHC, of the same base and altitude as the triangle.







The three lines which bisect the angles of a triangle meet in one point, which is the centre of the inscribed circle; and the three perpendiculars which bisect the three sides also meet in one point, which is the centre of the circumscribed circle. Moreover, the three lines drawn from the vertices bisecting the sides meet in one point, which is the centre of gravity of the triangle: as also do the three perpendiculars drawn from the vertices to the sides. All these propositions, except the second, can be proved by the same process, namely, by showing that the segments of the sides satisfy the theorem given in Transversal.

The number of isolated theorems which might be given on this subject is very large, but there is little, unconnected with the trigonometrical formulæ, which is of use in application.

TRIA'NGULA and TRIA'NGULUM AUSTRALE (constellations). The first (the Triangles) is a northern constellation, surrounded by Perseus, Andromeda, Aries, and Musca. It is one of the old constellations, but there is only one triangle in Aratus. Hevelius added the second. The second, or Southern Triangle, is a constellation of Bayer, lying between Ara, Centaurus, and the South Pole.

The principal stars are as follow:—

TRIANGULA.

Character. ( ) not in Bayer.	No. in Catalogue of		Magnitude.
	Flamsteed.	Astron. Society.	
α	2	198	4
β	4	228	4
(ι)	6	233	6
(c)	12	253	6
	16	300	7

TRIANGULUM AUSTRALE.

Character.*	No. in Catalogue of		Magnitude.
	Lacaille.	Astron. Society.	
γ	1267	1722	2
ε	1292	1757	5
β	1311	1798	3
δ	1338	1845	5
α	1381	1906	2

TRIANGULAR COMPASSES. [Compasses.]

TRIANGULAR NUMBERS. [Numbers, Appellations of.]

TRIANGULATION, a name given to the net-work of triangles with which the face of a country is covered in a Trigonometrical Survey.

TRIA'NTHEMA, a genus of plants of the natural family of Portulaceæ, so named from τρεῖς, three, and ἄνθος, a flower, in consequence of the flowers growing in threes, in the axils of the leaves. The sepals are oblong and coloured on the inside. Its stamens vary in number from 5 to 10 or 12, and hence cause this genus to be placed in different classes by Linnæan botanists. The ovary is half superior; style 1 or 2, filiform; capsule oblong, truncate, cut round. The species are found in the tropical parts of the old and new world, and in the subtropical parts of Africa. They occur as weeds in every part of the plains of India. Trianthema obcordata, like the plants of the family to which it belongs, is employed by the natives of India as a potherb; but the nauseous and bitter roots of T. monogyna are said by Dr. Ainslie to be employed as a purgative by the inhabitants of the peninsula of India.

TRIBE (*tribus*, φυλή). All the states of antiquity of which we have any records were divided into a certain number of tribes, consisting of the great bodies of citizens of which the state was composed. These tribes however were of two different kinds, either genealogical (γενικαί), or local (τοπικαί). (Dionys. Hal., iv. 14.) The former, which must be considered as the more antient of the two, were the different national elements of which a state was made up, that is, each was a distinct people, though akin to the others, and each traced its origin to some mythical ancestor; whence Dionysius calls such tribes genealogical. The other, or local tribes, to which a later origin must be assigned, and which in most cases superseded the old genealogical tribes, were artificial local divisions made for political and other purposes, and any one of them might contain people who, according to the genealogical division, would belong to different tribes. Thus we find in the history of Attica that the four original tribes were done away with after the institution of the ten local tribes by Cleisthenes; and at Rome the three antient Romulian tribes gradually died away after the establishment of the thirty local tribes of Servius Tullius. At Sparta alone the three original Doric tribes, the Hylleans, Pamphylians, and Dymanians, were retained without any change. Genealogical tribes may in many instances, as was originally the case at Rome, have inhabited different districts, so that they were at the same time local tribes; but this is merely an accidental circumstance.

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* Bayer put no letters except to constellations he had seen.

The number of the genealogical tribes was different in the different states of antiquity, and depended upon various circumstances, such as the number of national elements brought together to form a state, or the partiality of a race of men for particular numbers which were used as typical. Thus we find that the Doric states were in most cases divided into three, the Ionic into four, and the Romans into three tribes, or a multiple of these numbers. Although these tribes only contained freemen, they were not always on a footing of equality, but the most antient one, to which the others had only been added at some time by treaty or contract, always retained, at least for a time, a superiority over the others, and reserved for itself rights and privileges which were denied to the others. Such was the case with the Hylleans at Sparta, the Eupatrids at Athens, and the Ramnes at Rome. Each tribe was usually subdivided into smaller bodies, as at Athens into ϕρατρίαι and γένη, and at Rome into curiae and gentes. The number of senators and of the great officers of a state likewise bore a certain relation to the number of tribes or their subdivisions. The bond of union between such tribes was more or less loose according to circumstances; and the history of Attica gives us an instance of their being at war with one another. Each tribe had usually its separate religious observances and festivals, and the same was the case with its subdivisions.

All the tribes of which a state consisted formed the sovereign people (as at Rome the populus), which in many cases ruled over a subject population superior in numbers (περίοικοι, plebeians). When a Greek state sent out a colony to a foreign country, it appears to have been customary to divide the new state into the same number of tribes as that which existed in the mother-city, and the names also were retained; in some cases, as at Cydonia and Halicarnassus, both of which were Doric colonies, we only find mention of one tribe, which may have arisen from the fact that only members of one tribe of the mother-state took part in the establishment of the colony. (Wachsmuth, *Hellenische Alterthumskunde*, ii. 1, p. 15, &c.)

In regard to the later or local tribes, it is clear from the name itself that each inhabited a distinct district, containing either one or more townships, which were called in Attica δῆμοι, and at Rome *vici* or *pagi*. Every citizen belonging to a tribe was obliged to have his name registered in a township of his tribe, though he was not bound to reside in the same in which he was registered and to which he belonged.

Each tribe, whether genealogical or local, managed its own affairs and was headed by a tribune (φύλαρχος). The same was the case with the subdivisions of a tribe.

We have here only given a brief outline of the subject in general, as a more detailed account of the tribes in the different states of antiquity is given in the articles ATHENS, CLEISTHENES, SPARTA, ROME, SERVIUS TULLIUS, DORIANS, IONIANS, and others. Compare also Wachsmuth, *Hellen. Alterthumsk.*, ii. 1, p. 15, &c.; Hermann, *Political Antiquit.*; Schömann, *De Jure Publico Græcorum*, p. 165, &c.; Niebuhr, *Hist. of Rome*, i., p. 306, &c.; *Dictionary of Greek and Roman Antiquities*, art. 'Tribus.')

TRI'BOLO, NICOLO DI, an able sculptor, born at Florence in 1500, was originally brought up to the trade carpenter, but becoming acquainted with Sansovino [SOVINO], he studied under him. The first work on he was employed after quitting that master was statues of sibyls for the front of San Petronio at Bolo which figures (represented in Cicognara's work) at stamped his reputation. For the doors of the same ch he also executed some bas-reliefs of great merit. The tilence at Bologna in 1525 caused him to leave that but he soon returned to it, till the death of his patron, tolommeo Barbazzi, induced him to remove from it, an go to Pisa, where he was employed by the sculptor Pier santa. While at Pisa he was commissioned by Gio. Ba della Palla, who was collecting works of art for Franc to execute a statue of Nature, which, on being sent to F tainebleau, was admired as a choice production of art. employed his talents less honourably when, on Flor being besieged by Clement VII., in 1529, he treachero furnished that pope with plans and models of the city its outworks. His services on that occasion obtained Clement's patronage, who among other things emplo him to assist Michael Angelo in the sculptures inten for the chapel of San Lorenzo; and he had begun figures intended for the tomb of Giuliano de' Medici, representing Earth, the other Heaven, when he was abled from proceeding with them by an attack of a and hardly was he recovered when the pope's death p stop to the work. He was afterwards employed by grand-duke Cosmo I., in laying out the gardens and signing the fountains and statues of the Villa di Cas near Florence, of which extensive scheme of embel ment a very minute account is given by his friend and grapher Vasari. But although commenced, it was prose but slowly; which Vasari imputes in some measure Tribolo's own remissness; nor was it ever completed. purchasing the Palazzo Pitti, Cosmo engaged Tribo improve the gardens and decorate them with statues, & but hardly had he commenced his labours when he seized with an illness that carried him off, September 7 1550. (Vasari, *Vite*; Cicognara, *Storia de Scoltura*.

TRIBONIA'NUS. [JUSTINIAN'S LEGISLATION.]

TRI'BULUS (τρίβολος, three-spiked or pointed), a g of the natural family of Rutaceæ, the fruit of whic armed with prickles. It is termed Caltrops, from pronged instruments formerly employed and still in us the East for obstructing the progress of cavalry. T name Tribulus however occurs in antient authors, an described as being of two kinds, one terrestrial, the o aquatic. This no doubt is Trapa, or Water Caltrops. former has its leaves compared by Theophrastus to th of the *Cicer*, and having similar prickly fruit, there ca little doubt that the plant now known as Tribulus terr is that intended, while a third kind is probably a speci Fagonia, perhaps F. cretica. The genus Tribulus h 5-parted calyx; petals 5, spreading; stamens, 10; ov superior; capsule, 5, gibbous, spiny, many-seeded. T species are found in the south of Europe and the sub pical and tropical parts of the world, with diffuse o procumbent stems, with solitary white or yellow flowers the axils of the leaves, and *T. terrestris* is sometimes c tivated in the gardens of the West Indies on account the sweet scent of its flowers. This, as well as *T. cisto* has some aperient properties ascribed, and is ther sometimes used medicinally in the countries where it indigenous.

TRIBU'NUS (φύλαρχος), according to the etymolog the word, signifies any officer who is at the head of a [TRIBE], and conducts either the internal administrati a tribe, or represents it in its relations to other power the state. This signification applies indeed to some of officers of this name who occur in the history of Rom but in regard to others it must remain doubtful why t bore this name. The following is a list of all the Rom officers bearing the name of tribune.

1. *Tribunes of the Three Romulian Tribes.*—The ex ence of a tribune for the three antient patrician tribes, Ramnes, Tities, and Luceres, is attested by several passa of antient writers. (Dionys. Hal., ii., p. 82, ed. Sylbur Servius, *Ad Aen.*, v. 560; Pomponius, *De Orig. Jur Digest*, i., tit. 2, s. 2, § 20.) As regards their functions have no definite statements: they may have been intrusted with the management of the civil, religious, and milit affairs of their respective tribes.

2. *Tribunus Celerum* is an officer who only occurs in the history of Rome during the period when it was governed by kings. He was the commander of the 300 equites (celeres) who formed the king's body-guard, 100 being aken from each of the three tribes. He was, next to he king, the first person in the state. (Dionys. Hal., ii., p. 86; Pomponius, *De Orig. Juris; Digest*, i., tit. 2, s. 2, § 15.) L. Junius Brutus, towards the end of the kingly period, was appointed to this office, it is said, by Tarquinius Superbus, and in this capacity he convened the comitia of he curiae, in which the abolition of the regal power was proposed. (Liv., i. 59.) In the absence of the king, the ribunus celerum acted as his representative, and convoked the senate, as well as the comitia of the curiae, at which he presided. Laws passed under his presidency were called leges tribuniciae, in contradistinction to leges regiae, or such as were passed under the presidency of the king.

3. *Tribunes of the Servian Tribes.*—When Servius Tulius organised the body of plebeians by dividing them into thirty local tribes, each of them was headed by a tribune, who had to keep a register of the inhabitants of his district and of the condition of every household in it. (Dionys. Hal., iv., p. 219.) As the troops of the army and the taxes were levied according to these local tribes, this constituted the principal functions of the tribunes. The scrutiny into every household appears to have gradually ceased, partly because it was repugnant to the spirit of liberty, which was rapidly developing, and partly because the state obtained sufficient information through the census. When subsequently the Roman people became exempt from taxes, the main functions of the tribunes ceased, but they continued to exist, and it is not improbable that the tribuni aerarii, who are mentioned from the time that pay began to be given to the soldiers (B.C. 406) down to the end of the republic, are the same as the tribunes of the Servian tribes. (Niebuhr, *Hist. of Rome*, i., p. 421.) The tribuni aerarii had to levy the tribute in their tribes and to pay the soldiers with it. (Varro, *De Ling. Lat.*, iv., p. 49, ed. Bipont.; Gellius, vii. 10.) After the institution of the quæstors, the tribuni aerarii had only to levy the tribute and hand it over to the quæstors, who distributed the pay among the soldiers. The Lex Aurelia, B.C. 70, gave to these tribunes judicial power along with the senators and equites; but they were deprived of it by J. Cæsar. (Sueton., *Cæs.*, 41.)

4. *Tribuni Plebis.*—These were the most important among the many officers bearing the name of tribune, and whenever tribunes are mentioned without any further qualification, the tribuni plebis are meant. In the year B.C. 494, when the plebeians had been driven by the oppression of the patricians to secede to the Mons Sacer, peace was concluded between the two orders on condition that the plebeians should be allowed to have magistrates of their own, whose province it should be to protect the members of their order against the patrician magistrates, and whose persons should be sacred and inviolable. It was further agreed, that whoever should maltreat, kill, or compel a tribune to anything by force, should be outlawed and his property should be forfeited to the temple of Ceres. (Liv., ii. 33; Dionys. Hal., vi., pp. 410, 435.) These agreements however were insufficient to protect the tribunes against various annoyances of the patricians; hence it was found necessary, soon after the institution of the tribunate, to give still more security to the exercise of their power. A law was accordingly passed forbidding any one to interrupt or disturb the tribunes in their transactions with the plebs, and that any one who should act contrary to this law should give bail to the tribunes for any fine they might propose to the comitia to inflict upon him; those who refused to give bail forfeited their life and property. (Dionys. Hal., vii. 431, &c.; Livy, iii. 13; comp. Niebuhr, *Hist. of Rome*, ii., p. 98.) The inviolability of the tribunes was finally established after the time of the decemvirate by a law of M. Horatius.

As regards the number of the tribunes, who were of course taken from the plebeians alone, the accounts differ. Some state that two were elected on the Sacred Mount, and that these two afterwards chose three more colleagues: others say that five were elected at once; and others again that no more than two were appointed. But the probability is in favour of five tribunes, so that one was taken from each of the five Servian classes. Thus much only is certain, that in the year B.C. 457 the number of tribunes was increased to ten; so that if they really bore any relation to the classes, each furnished two. This number remained unaltered to the end of the republic. The tribunes were attended by public servants, called viatores, who carried their commands into effect.

The accounts about the manner in which the tribunes were originally elected are as contradictory as the statements about their original number. The statement of Dionysius and Cicero, that they were elected by the curiae, must either have arisen from a misunderstanding of the nature of the curiae, or from a confusion of the election and the sanction of the election; for the latter was a right which the curiae unquestionably possessed for a time. If, as Niebuhr thinks, they were intended to represent the classes, they were elected by the centuries; but it is much more probable that the college of tribunes, at the expiration of the year of office, appointed their successors, after a previous consultation with the plebs. The sanction of the curiae ceased to be necessary shortly before the time of the Publilian law; and after that time we have express testimonies that the tribunes were elected by the comitia of the tribes, under the presidency of one of the tribunes whose office was expiring. (Liv., ii. 56, &c.; iii. 64; Dionys. Hal., ix., pp. 598, 600, &c.) As it was necessary that all the tribunes should be elected on one day and before sunset, it often happened that when the business of election could not be completed within the lawful time, those who were elected had to fill up the number by co-optatio. This inconvenience was done away with in 448 by the tribune L. Trebonius, who got a law passed, ordaining that in future the elections should be continued the next day or days in cases where one day should be too short a time to complete them.

The field of action for the tribunes were the comitia of the tribes and other meetings of the plebeians, and they arraigned before the assembly of the plebs any one, whether private individuals or magistrates, who had violated the rights of the commonalty, and that without any fear of being interrupted in their proceedings. They themselves had no judicial power; they had only the right to drag the offender before the assembly of the people, and to propose a fine to be inflicted on him. In later times they sometimes deviated from this rule, and assumed the right of proposing capital punishment. Their lawful power was originally mere *auxilium*, that is, to afford protection, without any right directly to interfere in the affairs of the state. Their power, the Tribunicia Protestas, or Tribunicium Jus, was confined to the city and one mile beyond its walls. They were not allowed to spend a night outside the city, except during the Feriae Latinae, when all the people were assembled on the Alban Mount. The house of a tribune was regarded as a place of refuge for any one who thought himself wronged or oppressed, and the doors were left open by night as well as by day. From the first the plebeians regarded the tribunes not only as their protectors against patrician oppression, but as arbitrators in matters among themselves. (Walter, *Geschichte des Röm. Rechts*, p. 85.) The power of the tribunes, after it was once established, rapidly increased in proportion as the commonalty itself increased in importance; indeed we may say that the growing importance of the commonalty was the work of the tribunes. Not quite forty years after the institution of the tribunate we find the members present at the deliberations of the senate; and in B.C. 454 the tribunes compelled the senate to meet, in opposition to the consuls, that they might lay before them a rogation, and discuss its merits. (Dionys. Hal., x., pp. 628, 657.) Henceforth either the tribunes themselves, or the consuls at their request, proposed legislative measures to the senate, as we see in the instance when a new legislation was demanded by the tribunes. (Dionys., x., p. 678.) This demand of the tribunes, after some struggles on the part of the patricians, was at last complied with, and led to the appointment of the decemvirs, for the purpose of framing a new code of laws. During the second decemvirate the tribunate was suspended, like all other magistrates; but when the business of legislation was completed, tribunes were again appointed, and it was on their proposition that the consulship also was restored. (Liv., iii. 54.)

The position of the tribunes after the decemviral legislation was very different from what it had been before. Henceforth we find the patricians and the clients contained in the tribes, and the tribunes now stand in the same relation to the whole nation as they had before stood to the commonalty only: they are now the protectors of the whole nation as assembled in the comitia of the tribes, and in opposition to the senate and the magistrates; they are the representatives of the democratical element in the state, in opposition to the aristocratical. This explains how it happened that their protection was sought by patricians as well as plebeians. (Liv., iii. 56; viii. 33, &c.) They henceforth also appear in the possession of the right of being present at all the deliberations of the senate; but their place was outside the opened doors, where they sat upon benches. They had at all times the right to propose measures to the assembly of the tribes, which might pass them. Such resolutions of the tribes were called plebiscita, and required the sanction of the senate or the curiae before they became laws. But the Lex Valeria ordained that all plebiscita should be binding upon the whole nation without any further sanction. (*Dictionary of Greek and Rom. Ant.*, under 'Plebiscitum.') This gave to the tribunes an extraordinary influence in all the affairs of the state, and the democratical element had now gained the superiority. But while the power of the tribunate was thus outwardly increasing, a change took place within the body, or collegium, as it was called, which, to some extent, paralyzed its power. Down to the year B.C. 394 all matters had been decided in the college of the tribunes by a majority of the members, but in this year we meet with the first instance of the intercession (veto) of one tribune rendering the resolution of his colleagues void. (Liv., v. 25, 29.) It is uncertain what gave rise to this innovation, but it weakened the power of the college, inasmuch as the aristocratic party might easily gain over one of its members, and thus thwart the plans of the rest. In such a case nothing could be done, and the matter was dropped. C. Tiberius Gracchus was the first who pointed out the manner in which the college might get rid of an obstinate member: he proposed to the people to deprive such a tribune of his office, an expedient which was afterwards occasionally made use of. The same power however which a tribune had over the resolutions of his colleagues he also had upon the proceedings of a magistrate, whether a consul, a censor, or a praetor, and even over an ordinance of the senate. The right of the tribunes of merely appearing in the senate was gradually increased by the power of convoking the senate, and laying before it any measures relating to government or administration; and the senate had often recourse to the tribunes for the purpose of compelling magistrates to comply with its wishes. (Liv., iv. 26; v. 9; xxviii. 45.) At last it was established by the Plebiscitum Atinium that a tribune should be a member of the senate by virtue of his office. The time when this plebiscitum was passed is uncertain, though it is not improbable that it originated with C. Atinius, who was tribune in B.C. 130.

In regard to other magistrates the tribunes had not only the power to stop any of their proceedings, but in case of need they might seize the highest magistrates, and put them into prison, or inflict capital punishment upon them by throwing them from the Tarpeian rock. There was no power in the Roman republic that could be compared to that of the tribunes, and during the latter period of the republic they formed a real democratical senate. But whatever may have been the abuse that some tribunes made of their exorbitant power, and however much evil they may have produced, yet it is a point acknowledged on all hands that Rome owed her greatness, in no small degree, to the institution of the tribunate.

Sulla, in his attempt to remodel the constitution upon aristocratic principles, reduced the powers of the tribunes to what they had been originally. But this innovation, like all his constitutional changes, was a complete failure, and the full power of the tribunes was restored to them by Pompey. [SULLA; POMPEY.]

During the empire the college of tribunes of the people continued to exist; and in the reign of Augustus, comitia for the election of tribunes were still held, although the freedom of election gradually disappeared. (Sueton., *Aug.*, 40; Vellei. Pat., ii. 111.) The political influence of the tribunes also sank rapidly, and even at an early period of the empire we find it almost confined to intercession in decrees of the senate and to protecting oppressed or injured individuals. (Tacit., *Annal.*, xvi. 26; *Histor.*, ii. 91; iv. 9; Plin., *Epist.*, i. 23; ix. 13.) Tribunes however continued to exist down to the fifth century of our æra; and though their power was much limited, they still continued to be looked upon as the protectors of the weak and the injured, which made their office one of great moral importance. For this reason, as well as for the purpose of having a check upon the college, the emperors, although patricians, found it necessary to be tribunes. In fact, the office of tribune, all the other magistracies being united in one person, was the only thing that was wanting to complete the sovereign power of an emperor. In A.U. 731 Augustus received the office of tribune for life, and at intervals of five years he himself appointed one of his friends or relatives as his colleague in the tribunate. (Sueton., *Aug.*, 27, 40; *Tiber.*, 9.) This tribunicia potestas of an emperor was conferred upon him by the senate, and was justly deemed equivalent to regal or dictatorial power with a popular name. (Tacit., *Annal.*, i. 2; iii. 56.) The example of Augustus was followed by his successors, and the tribunicia potestas became an essential part of the imperial dignity, and was finally established as such by the Lex de Imperio Vespasiani. (Suet., *Tiber.*, 23; *Vesp.*, 12; *Titus*, 6.)

5. *Tribuni Militum cum Consulari Potestate.*—In the year B.C. 445 the tribune C. Canuleius carried several rogations, one of which was, that the people should be at liberty to elect the consuls from the patricians and plebeians indiscriminately. In order to avoid the consequences of this law, the senate decreed that instead of consuls, tribuni militum with consular power should be elected promiscuously from both orders; and in order that the plebeians might not gain too much at once, the censorial power, which had hitherto been a part of the consular power, was separated from it and given to two new patrician officers, the censors. Accordingly in the year 444 B.C. three tribunes were elected instead of consuls, and one of them was a plebeian. The people however were allowed for the following years to elect either tribunes or consuls, as they might think proper. The consequence was, that for a series of years sometimes consuls were elected according to the old custom, and sometimes tribunes. From the year B.C. 426 the number of tribunes varied between three and four, until in B.C. 405 it was increased to six, which remained unaltered down to the year B.C. 366, when the office of the military tribunes with consular power was abolished, and the consulship restored. These consular tribunes, as they are briefly called, had the same power as the consuls, with the exception of that part of it which had been detached from it and given to the censors. For this and other reasons the patricians did not so much object to its being shared with the plebeians, as they did in regard to the consulship, which was sanctified by solemn auspices. (Liv., iv., v., vi.; Dionys. Hal., xi., p. 736, to the end; Diodor., xv.; compare Niebuhr, *Hist. of Rome*, ii., p. 325, &c.; 389, &c.)

6. *Triburi Militares*, or *Militum*, or tribunes of the soldiers, were a class of officers in the Roman armies, of whom at first there were four in a legion. They appear originally to have been appointed by the consuls, but in the year B.C. 363 it was decreed that henceforth half of them should be elected by the people in the comitia of the centuries, while the appointment of the other half was left to the commanders of the legions as before (Liv., vii. 5), and as there were six in a consular army, three were elected by the people and three by the consul. The latter were, down to the latest time of the republic, called *ruffuli*, and the former *comitiati*. (Liv., vii. 5; Festus, s. v. 'Ruffuli.') In later times the number of tribunes for each legion was increased to six, and their appointment was sometimes left altogether to the consuls. (Liv., xlii. 31.) But this seems to have been an exception to the rule, for subsequent to that time we again find that the people had the election of a part of the tribunes. (Liv., xliii. 14; xliv. 21.) The functions of these tribunes of the soldiers consisted in maintaining the discipline among the troops, superintending their exercises and their state of health, in inspecting the sentinels, settling disputes among the soldiers, in taking care that they received their necessary provisions, and the like.

(For further particulars see *Dictionary of Greek and Roman Antiquities*, under 'Tribunus.')

TRIBU'NUS (Τριβοῦνος), a celebrated physician, who was born in Palestine, and lived in the sixth century after

Christ. He is said by Procopius (*De Bello Goth.*, lib. iv., cap. 10) and Suidas (*in voce* Τριβοῦνος) to have been one of the most skilful of his profession, and is also described as being wise, temperate, and pious. Chosroes, king of Persia, held him in such estimation, that when he was treating about a peace with the emperor Justinian, A.D. 546, he would not so much as make a truce with him, except on the condition that Tribunus, whose skill in physic he wanted and was acquainted with, should be sent to him for one year; and the historian remarks that as soon as this was done, a truce was concluded for five years. (*De Bello Pers.*, lib. ii., cap. 28.) Tribunus had formerly cured Chosroes of an illness, for which he was rewarded with great presents, and returned to his own country. After the truce just mentioned he stayed a whole year with Chosroes, who offered to give him whatever he demanded; instead however of asking for money, he desired that some of the Romans who were captives in Persia might be set at liberty. The king at his request not only released those whom he had particularly named, but three thousand others besides, which made the name of Tribunus famous throughout the whole extent of the empire. (Freind's *Hist. of Physic.*)

TRICELLA'RIA, a genus of celluliferous corallines. [Polypiaria; Membranacea; Cellariæa.]

TRICHAS. [Sylviadæ, vol. xxiii., p. 441; Titmice.] Mr. Swainson thus characterises this genus:—

Bill somewhat conic, compressed; the base a little widened: both mandibles equally thick; the upper very slightly bent and notched: gonys ascending. Rictus bristled. Wings short; the first and second quills slightly graduated. Tail rounded. Feet large, slender. Tarsus long. Middle toe shorter than the tarsus; lateral toes equal.

Example, *Trichas personata*. Wilson, 1, pl. 6, f. 1.

Mr. Swainson considers his subgenus *Seiurus* to be annectant to *Trichas*.

TRI'CHECHUS. [Seals, vol. xxi., p. 168.]

TRI'CHIA. [Trichospermi.]

TRICHI'ASIS (τριχίασις), is a disease in which one or more of the eyelashes are turned inwards, so as to be in contact with the front of the eyeball. The irritation thus excited produces all the pain and other symptoms of inflammation of the conjunctiva, and if long continued may terminate in opacity of the cornea and complete blindness.

The wrong direction of the eyelashes may depend on various causes. Sometimes it appears to be their natural mode of growth; one or more growing differently from the rest, and being reproduced with the same fault as often as they are extirpated. More frequently it is due to some disease of the eyelid, producing a cicatrix or induration of its inner surface, which, contracting, draws in the margin of the lid, and with it the lashes. By a similar process, trichiasis is the constant accompaniment of the cases of entropium, or inversion of the eyelids, which depend on induration or contraction of their cartilages.

A temporary remedy for trichiasis is the extraction of the offending eyelashes, which may be effected by plucking them with broad-pointed forceps; but they are generally quickly reproduced, and, growing in the same direction, renew the patient's suffering. For a permanent remedy, some of the operations for entropium must be performed, or the portion of the inner margin of the eyelid from which the inverted lashes grow must be removed with their bulbs.

TRICHI'LIA, a genus of plants of the natural family of Meliaceæ, so called from the Greek *tricha* (τρίχα), 'ternary,' many parts of the plant being produced in threes. The genus is characterised by having the calyx 4-5 divided. Petals 4 to 5, connected at the base. Stamens 8 or 10; filaments flat, sometimes distinct, sometimes closely joined into a tube, bearing the anthers between the teeth of the tube. Style crowned by a capitate 3-lobed stigma. Capsules 3-valved, 3-celled, cells 1-2-seeded. Seeds baccate with an axil. Embryo inserted with very thick cotyledons. The species form trees or shrubs, with alternate unequally pinnate or trifoliate leaves, with axillary panicles of white flowers, which are sometimes subfasciculate. They are found in the tropical parts of America, and a few in Africa and in New Holland. An Indian species, T. spinosa, is not well known, but the oil of its seeds is said to be a useful remedy in chronic rheumatism and paralytic affections. Several are possessed of active properties. Forskal found the fruit of one species in the mountains of Yemen used as an emetic, and called jouz-al-cai, or the emetic-nut, whence he named it Elcagi, now called *Trichilia emetica*. The seeds, bruised, are used for washing the hair, as well as an application in itch. T. trifoliata, a native of Curaçoa, has an unpleasant smell in all parts, and is said to possess active properties. T. cathartica is described by Martius as having great bitterness, and as employed in Brazil as a cure for fevers, &c. T. moschata is remarkable in Jamaica for the odour of musk which it diffuses all around, on which account it is called musk-wood.

TRICHINO'POLI, a fortified city of Hindustan, formerly the capital of a Hindu principality, now included in the presidency of Madras and province of the Southern Carnatic, is situated about half a mile from the south bank of the river Cavery, in 10° 50′ N. lat. and 78° 49′ E. long.

The principality of Trichinopoli, a relic of the kingdom of Madura, of which it originally formed a part, retained its independence till 1736. On the death of the last Raja the government passed into the hands of his widow, as regent for his adopted son, and from her it was treacherously wrested by Chanda Sahib, a son-in-law of Dost Ali, nabob of the Carnatic, and was then made tributary to the Mohammedan government. In 1741 it was taken by the Mahrattas, and Chanda Sahib was carried as a prisoner to Sattara; it was however retaken by Nizam al Mulk in 1743, and in 1749 it devolved by inheritance to Mohammed Ali as nabob of the Carnatic. Dupleix, the French general, in 1748 had advanced the sum required by the Mahrattas as ransom for Chanda Sahib, whose wife and family had been protected by the French at Pondicherry during his imprisonment. In 1751 Mohammed Ali, who was assisted by the British, was besieged in Trichinopoli by Chanda Sahib, assisted by the French. The defence was conducted by Lawrence, Clive, and other British officers, with extraordinary military skill, and the siege was continued till 1755, when the French and their allies were compelled to retire. The grounds of this contest are stated in the article Carnatic. The district and city of Trichinopoli were ceded to the British in 1801.

The city of Trichinopoli is situated on a rocky eminence; it is very large, and is said to contain, including the suburbs, 80,000 inhabitants. The houses generally are inferior to those of the neighbouring city of Tanjore. The chief public buildings are, a palace, a mosque, and two Hindu temples. The fortress is strong, and the British government generally keeps five or six regiments there, partly on account of the salubrity of the situation, and partly as a convenient point of communication with other parts of southern Hindustan. A mission-church was founded here by Schwarz in 1762 [Schwarz], which still retains a congregation of about 500 converts. The mission-church and mansion-house of Schwarz are within the fortress. Bishop Heber died suddenly at Trichinopoli in 1826, when taking a cold bath, and was buried in the church. [Heber.]

Trichinopoli is 107 miles S.W. from Pondicherry, 38 W. from Tanjore, and about 90 from the Bay of Bengal, travelling distances. The surrounding country is fertile, from the means of irrigation afforded by the Cavery and Coleroon, though not equal in fertility to that of Tanjore.

The peninsula called the island of Seringham, near Trichinopoli, is formed by the Cavery, which, about five miles above Trichinopoli, divides into two branches. The northern branch is called the Coleroon; the southern retains the name of Cavery. The two rivers again approach each other about fifteen miles below Trichinopoli, where the Cavery is prevented from flowing into the Coleroon, which is there lower than the Cavery, by a large mound. [Tanjore.] The peninsula thus formed is called the island of Seringham. In this island, five miles from Trichinopoli and near the south bank of the Coleroon, is situated one of the largest and most magnificent pagodas in Hindustan. The central sacred building is not large, but is splendidly ornamented with sculptures, gilding, and valuable stones. It is enclosed within seven square walls, each twenty-five feet high and very thick; these walls are about 120 yards from each other, and, besides common entrances, there are twenty very large and lofty triangular towers over as many gateways, each forming a highly ornamented pagoda. The circumference of the outer wall is about four miles, so that the enclosure occupies about a square mile. A great number of sacred edifices are scattered about, some of which have halls of vast size; the flat roof of one of them is supported by a thousand slender columns of carved granite. The pavements, stairs, and lower parts of the temples are mostly of red and grey granite, and of sienite. There are numerous sculptures, tolerably executed. Besides the sacred buildings, there are a great number of well-built houses and shops, where business is carried on by inferior castes. Most of the inhabitants however, who amount to about 8000, are Brahmins. A great number of pilgrims resort to the temple annually.

(Mill's *History of British India*, by H. H. Wilson; Hamilton's *East India Gazetteer;* Malcolm's *Travels in Hindustan and China in* 1836 *and* 1837.)

TRICHODERMA'CEÆ, a tribe of plants belonging to the suborder Gasteromycetes, of the natural order Fungi. It is characterised by its peridium being composed of loosely interwoven flocci, rarely membranous, and evanescent in the centre. The sporidia are conglomerate, and the texture of the whole plant is floccose. This tribe includes several small genera. The genus Asterophora is found on other fungi when in a decaying state, especially the Agarics. The genus Onygena is remarkable for being found on the hoofs of various animals, more especially those of the horse. It has also been found on horns, and was gathered by Dr. Richardson in the arctic regions on the horns of a buffalo. The species of the genera Trichoderma Myrothecium and Agerita are found in Great Britain on fallen trees, dried plants, and various kinds of decaying wood.

TRICHODESMA (from the root τριχο, 'hair,' and δέσμος, a 'bond'), a genus of plants of the natural family of Boragineæ, so named from the stamens being united together by interwoven hairs. The genus has a rotate corol with a naked orifice and subulate segments. The exserted stamens have the anthers villous at the back. Nuts half immersed in the four-winged column. The species were formally united with Borago, but have been separated by modern botanists: they are common in India and in New Holland. The plants have little beauty and are of little use. T. indica and zeylanica are reputed in India to have diuretic properties, but are probably only demulcent. They are likewise reckoned among the numerous plants which are supposed to have the power of curing the bites of snakes, but probably possess no other power than what they derive from their mucilaginous nature.

TRICHOGLO'SSUS. [PSITTACIDÆ, vol. xix., p. 90.]

TRICHO'PHORUS, M. Temminck's name for a genus of birds, placed by Mr. Swainson under the family MERULIDÆ (vol. xv., p. 121); and by Mr. G. R. Gray, in his subfamily *Pycnonotinæ*, the fifth of his *Turdidæ*.

TRICHOSANTHIS, a genus of the natural family of Cucurbitaceæ, so named (from τριχο, 'hair,' and ἄνθος, a 'flower') from the corols being fringed, something like those of the Marsh Trefoil. Many of the species are edible, and from the long, often sinuous-formed fruit, they have been named Snake Gourds; the Anguina of some botanists. The genus is characterised by having white monœcious flowers, calyx of the male somewhat club-shaped, 5-parted, segments subulate. Corol 5-partite, ciliate. Stamens 5, but in three bundles. Anthers very flexuose. Female flowers, calyx 5-toothed, corol 5-partite, cut and ciliated. Style trifid. Stigmas oblong, subulate. Fruit a pepo, oblong, in some globose, 1 or 3 celled. Seeds imbedded in pulp. Plants trailing or climbing, found in the hot and moist parts of Asia, especially India, with a few species in the West Indies.

The principal edible species are *T. anguina*, a native of India and China, with annual climbing pentagonal stems, leaves more or less 5-lobed, tendrils trifid, very long: male flowers in a long peduncled raceme; females solitary on a short peduncle from the same axils with the male. Fruit oblong, spindle-shaped, ending in a long beak. The fruit is often nearly a foot long, and, on account of it, the plant is much cultivated in different parts of Asia; the fruit being universally used in the stews and curries of the natives of India, and is called by them *chuchinda*. T. dioica is another cultivated species; *pulwul* of the natives. The plant is diœcious, herbaceous. Leaves cordate, dentate, scabrous; both male and female flowers solitary. Pepos oblong, both ends obtuse; when ripe, smooth and of a deep orange colour; about four inches long and the same in circumference. The unripe fruit and tender tops are much eaten both by Europeans and natives in Bengal, in stews and curries. This is one of the most useful and extensively cultivated species of the genus. *T. cucumerina* is a third cultivated species with broad cordate leaves from three to five lobed, margins toothletted: male flowers racemed; female ones solitary; fruit oval, or oblong, from one to four inches long; when ripe, red, with the seeds involved in a red pulp. The unripe fruit of this species, like that of the others, is eaten in stews, but is bitterish in taste.

The bitter principle is secreted in much larger proportion in some of the other species, which are hence used medicinally, as *T. laciniosa*, *amara*, *incisa*, and *palmata;* some being stomachic, but others purgative, where a larger portion of the active principle is secreted.

TRICHOSPERMI, a tribe of plants belonging to the suborder Gasteromycetes, of the natural order Fungi. It is known by its peridium being single or double, bursting when full grown, and pouring forth abundant naked dust-like sporidia. The sporidia are subglobose and rather large, and are collected more or less in the centre of the peridium, and are loose or interwoven with the flocci. The genera belonging to this order are rather numerous, and are divided into Trichogastres, those having a fleshy consistence; and Myxogastres, those having a soft and mucilaginous consistence.

To the first division belong all those forms of fungi which are popularly known as puff-balls, blind-man's-buff, devil's snuff-boxes, &c. They have obtained these names on account of the property they possess of giving out, when in a ripened state, the sporules with which their interior is filled. These sporules are so exceedingly small and light, that on the peridium, or external covering of the plant, being broken, they rise into the air like smoke. Many of these sporules do not measure more than from $\frac{1}{10000}$ to $\frac{1}{20000}$ of an inch in diameter. They possess a curious property of repelling the particles of water, so that if the surface of a basin of water is covered with them, the hand may be plunged to the bottom of it without being wetted. Most of the plants which are called puff-balls were arranged by the older botanists under the genus Lycoperdon, but they are now arranged under several distinct genera. The genus *Geaster* embraces those puff-balls whose peridium is double, the outer layer of which splits up into star-like expanding rays. On account of this star-like appearance they have been called ground-stars, and to distinguish them from other puff-balls, starry puff-balls. They are found frequently in great abundance in meadows and pastures, under hedges amongst decaying leaves, and on the ground in woods, plantations, and shrubberies. Nine species of this genus are found in Great Britain. The genus *Bovista*, bull puff-ball, has a thin paper-like covering, which is furnished with a distinct bark, which peels off as the plant grows old. There are two species of this genus common in England, where they are found on the ground on heaths and dry pastures. The genus *Lycoperdon*, sometimes called wolf puff-ball, differs from Bovista in its peridium being membranaceous, and its thin external bark not being entirely deciduous. The most remarkable species of this genus is the *L. gigantea*, giant puff-ball, which is sometimes met with in fields and plantations in Great Britain. It may be known directly by its large size, specimens frequently measuring several feet in circumference. The peridium of this plant is very brittle, and contains inside a dark pulpy mass, having a disgusting appearance, which is composed of flocci mixed with the dark olive-brown sporidia. When dry, the inside of this and other puff-balls have been used for the purpose of restraining hæmorrhage by direct application to a wounded part. For this purpose it at one time formed an essential article in the case of every surgeon. It is now seldom used among medical men, but it has still a great popular reputation. The application of this remedy seldom stops the bleeding of a wound sooner than a piece of lint; and its introduction into a wound, especially after the operation of phlebotomy, may be attended with unpleasant if not dangerous symptoms.

Another species of puff-ball common in our pastures is the dwarf *L. pusillus*. It may be known by its small size. The most common of all the species of Lycoperdon is the *L. gemmatum*, the studded puff-ball. This and the preceding species, and the *L. pyriforme* of Schœffer, were placed at one time together, under the name *L. Proteus.* This name was given them on account of their exceedingly varying character. The *L. gemmatum* is known from the other species by its peridium being studded over with subspinulose warts. These warts vary very much in size and form, and this circumstance has given rise to a number of varieties of this plant being named as species by different writers on fungi.

The genera *Scleroderma*, *Elaphomyces*, and *Cenococcum* are distinguished by the hard, corky character of their peridium, which sometimes approaches the consistence of horn. They are common on dry ground, on heaths, in gardens, woods, &c. The *Elaphomyces officinalis* is used by some German physicians as a medicine. The second division of the Trichospermi, the Myxogastres, contains a larger number of genera than the first, but the plants are much smaller and less obvious. They are most of them very minute, and are found on the trunks of old trees and on decaying wood. Their forms and colours are exceedingly various, and sometimes very beautiful. Their structure is more delicate than the plants of the last division, and as their consistence is soft and gelatinous, their character is with difficulty retained after they have been gathered. One of the best-known genera of this division is the *Lycogala*, or wolf-milk, so called on account of its containing in the early stages of its growth a quantity of whitish matter of the consistence of clotted cream. The only British species is the *L. Epidendrum*, which is found on rotten stumps and pales in the spring and autumn of the year. This plant varies much in size and colour. Its covering is frequently of a blood-red colour, as also the juice which oozes out from the interior. The colour of the pulp of these fungi depends on their sporules, and as these are so excessively minute, they can be employed when mixed with gum-water to form various coloured pigments.

The genus *Spumaria* is found attached to the stems of grasses, and looks like a thick white froth upon them. On this account it is frequently supposed to be of animal origin. The genera Trichia, Physarum Stemonitis, Didymium, Craterium, Cribraria, Arcyria, &c., are named from the peculiar forms the species assume. They are mostly found on rotting wood in the spring and autumn of the year. The best account of the British species of these plants will be found in the 5th volume of Smith's 'English Flora,' executed by the Rev. M. J. Berkeley.

TRICHO'TROPIS (from the root τριχο, 'hair,' and τρόπις, 'a keel'), the name given by Mr. Broderip and Mr. Sowerby to a genus of turbinated testaceous mollusks whose shells have somewhat of the shape of *Turbo*, but are distinguished from that genus by their thinness, and from *Buccinum* by the want of a notch at the base of the aperture, and by the very indistinct canal. From *Turbo* it may be easily known also by its elliptical and not spiral operculum, and by the absence of the ciliated lateral membranes which belong to the *Turbines*, and it is distinguished from *Buccinum* moreover by the discrepancies in the soft parts. From *Cancellaria* it differs in being destitute of the oblique folds near the base of the columella; but it seems to be the type connecting the true *Buccina* (*Buccinum undatum* and its congeners) with the *Cancellariæ*.

Generic Character.—*Shell* turbinated and carinated externally; the aperture wide, but still longitudinal and rather longer than the spire, its base entire without any notch, although immediately below the obliquely truncated base of the columella there is an indistinct canal. The whole shell thin and delicate, the outer lip especially. *Epidermis* horny, forming numerous sharp-pointed bristle-like processes on the edges of the carinæ outside the shell, very strong, and by its contraction in drying frequently breaking the edge of the lip.

Operculum horny, much smaller than the aperture, composed of elliptical laminæ, its apex or nucleus lateral.

Animal resembling in most particulars a *Buccinum* as to its external form and characters, differing from it principally in having only a very small fold of the mantle to line the nearly obsolete canal of the shell. This and some other inequalities on the edge of the mantle corresponding in position to the keels on the outside of the shell, constitute the whole of the differences observable between the soft parts of the animals.

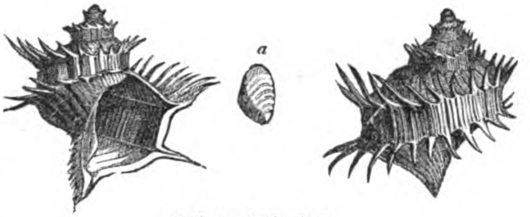
But two or three species of this genus are known: the authors name two, *Trichotropis bicarinata* and *Trichotropis borealis*: whether the *Fusus* 4-*costatus* of Say might not with propriety constitute a third species of this genus, must in their opinion remain undecided. This last shell is a fossil which attains a considerable size, and differs materially from both the species described by Mr. Broderip and Mr. Sowerby in having an enormous umbilicus. We select *Trichotropis bicarinata* as our example. Several specimens of *Trichotropis borealis*, which is found in the Northern Ocean near Melville Island, were brought to England by Captain (now Sir W. E.) Parry and Lieutenant Griffiths, and a single specimen was found at Oban in Argyleshire by the Rev. T. Lowe: Lieutenant (now Captain) Belcher procured one specimen at Icy Cape.

Description of *Trichotropis bicarinata.*—*Shell* with four or five volutions, the last of which is much larger than the others, and ventricose; smooth on the outside, with two prominent keels, which are ornamented with the numerous strong, sharp-pointed, bristle-like processes formed by the epidermis. The aperture is large and rather triangular, being however rounded externally, with two obtuse angles, and pointed at the base. The shell has a very narrow, linear umbilicus, which is carinated on the outer edge, and its carina is bristly like those on the back; its inner edge is formed by the elevation of the edge of the inner lip. The columella is rather flattened. Shell white, translucent; *epidermis* pale horn colour.

Syn.—*Turbo bicarinatus*, Sowerby, in 'Tank. Cat., App.,' p. xii.

Habitat.—The Arctic Ocean.

Near the apex of the shell which was in the Tankerville collection, and afterwards passed into the cabinet of the late Dr. Goodall, two *Terebratulæ* were attached. Some small *Balani* had fixed their abode on the body-whorl of one of the specimens brought home by Lieutenant Belcher, and two of them were near the lip. Dr. Goodall's specimen was said to have been brought from Newfoundland; those from which this description was taken were dredged up in from ten to fifteen fathoms water, in the bay between Icy Cape and Cape Lisbon.



Trichotropis bicarinata.

a, operculum.

TRICKLASITE. [Fahlunite.]

TRICOCCÆ, the name of a natural order in the 'Fragments of a Natural System' of Linnæus. Euphorbia was selected by Linnæus as the type of this order. In the system of Jussieu as adopted and amended by De Candolle and Lindley, this order is called Euphorbiaceæ. The original name Tricoccæ is however still used by Bartling to express a group of families, amongst which is Euphorbiaceæ, with Rhamnaceæ, Staphyleaceæ, Celastraceæ, Brunoniaceæ, and other small orders.

TRIDA'CNA. [Tridacnidæ.]

TRIDA'CNIDÆ. The *Tridacnacea* of Lamarck form a family belonging to the first section of his *monomyarian Conchifers*, or mollusks furnished with bivalve shells which have a single muscular impression. This family comprises the genera *Tridacna* and *Hippopus*.

Cuvier makes the *Camacées* the third family of the testaceous *Acephala*. For the genera which he arranges under that family, and for the views of Linnæus, Bruguière, De Blainville, Rang, and others, see the article Chamacea.

The *Chamidæ* of Mr. Swainson are placed between the *Tellinidæ* and the *Saxicavidæ*, and contain the following genera and subgenera:—

1. *Hippopus*, Lam., with the subgenus *Pleurorhynchus*, Phillips.

2. *Chama*, Linn., with the subgenus *Isocardia*, Lam.

3. *Tridacna*, Lam., with the subgenera *Cleidothærus*, Stuchbury, *Diceras*, Lam., and *Myochama*, Stuchbury.

4. *Cardita*, Lam., including *Venericardia* and *Cypricardia*, Lam.

Mr. Swainson remarks that the latter seems to be an aberrant *Cardita* passing into *Coralliophaga*.

Mr. J. E. Gray makes the *Chamidæ* the first family of his *Goniopoda*, the third order of the *Conchifera* in his arrangement. This family, which is immediately followed by the *Ætheriadæ*, consists of the genera *Chama*, *Arcinella*, *Diceras*, and *Caprina?* The *Tridacnidæ* are placed by him as the first family of his *Pogonopoda*, the fourth order of the *Conchifera*, and comprise the genera *Tridacna* and *Hippopus*. The *Tridacnidæ* are immediately followed by the *Dreissenidæ*. (*Synopsis*, *Mus. Brit.*)

M. Deshayes observes, in the last edition of Lamarck, that the character fixed on by the latter for his section, namely 'Ligament marginal, elongated on the border, sublinear,' is not applicable to the three families, the *Tridacnées*, the *Mytilacées*, and the *Malleacées*, which he arranges under it. The *Malleacea*, in fact, remarks M. Deshayes, have no external convex ligament similar to that of the dimyarian conchifers, whilst the ligament is found precisely so constructed in the two families which, in conformity with their nervous system, he proposes to place among the *Dimyaria*. The structure of the ligament, he says, confirms this view; and he notices the judicious observations of Lamarck, that the *Tridacnidæ* have no analogy with the other *Monomyaria*, and that, in structure, the animal more nearly approaches the *Chamacea* and the *Cardiacea* than any other. Thus, M. Deshayes remarks, it will be advisable to return to the opinion of Cuvier, who places the *Tridacnæ* in the neighbourhood of the *Chamæ*, as indeed Linnæus had done before him; for the Swedish naturalist arranges under his genus *Chama* both the *Chamæ*, properly so called, and the *Tridacnæ*. The observations made by M. de Blainville with respect to *Hippopus* appear to M. Deshayes to be well founded; and he is of opinion that it will be necessary to suppress that genus, the principal character of which (the closed lunule) is valueless, inasmuch as it does not coincide with the animal, which is similar to that of *Tridacna*. M. Deshayes remarks that Lamarck would certainly not have separated the genera, if the latter had known that some *Tridacnæ* as they advance in age have the lunule much narrower than it is in youth, and had been acquainted with the animal of *Hippopus* which is figured by M. Quoy in the 'Voyage of the Astrolabe' (pl. 80), and differs in nothing from that of *Tridacna*, excepting that the foot is rather smaller and without byssus. For figures of the animals of several *Tridacnæ*, see the 'Voyage of the Astrolabe,' pl. 79, 80.

Lamarck's generic character of *Hippopus* is,

Shell equivalve, regular, inequilateral, transverse, with a closed lunule. *Hinge* with two compressed teeth, anterior and intrant. *Ligament* marginal, external.

Tridacna.

Animal oval, cordiform, having the lobes of the mantle united nearly throughout the circumference: three apertures; two posterior and inferior for the anus and for respiration, the third anterior, corresponding with the gape of the lunule, and giving passage to a thick, cylindrical, and byssiferous foot in nearly all the species. *Mouth* oval, furnished with great lips, at the extremity of which are two pairs of pointed labial palps. (Deshayes.)

Generic Character.—Shell regular, equivalve, inequilateral, transverse; with a gaping lunule. *Hinge* with two compressed, unequal, anterior, and intrant teeth. Ligament marginal, external. (Lam.)

M. de Blainville divides the genus *Tridacna* into the two following sections:—

A. Species whose shell is more elongated, and more inequilateral, the anterior side being longer than the posterior; the lunule widely open in youth for the passage of a byssus.

Example, *Tridacna gigas.*

B. Species more equilateral; the anterior side shorter than the posterior, and forming a vast lunule entirely filled up; umbones curved forwards; a single postcardinal tooth on each valve. (Genus *Hippopus*, Lam.)

Example, *Tridacna Hippopus.*

Habitat of the genus: the East Indian Seas principally. The species have been found moored to rocks and on coral reefs, from the surface of the sea to the depth of several fathoms.

Description of Tridacna gigas.—Shell very large, transversely oval, with great imbricato-squamous ribs, the scales short, arched, and lying near together; the interstices of the ribs not striated.

Lamarck, whose description this is, inquires whether the species so described is the *Chama gigas* of Linnæus; and M. Deshayes in the last edition of the *Animaux sans vertèbres* observes that it is very difficult now to establish its synonym, because all authors, instead of giving a reduced figure of large individuals, have contented themselves with representing what they have taken for young shells of the species. Among these figures, many, he remarks, evidently belong to other species; but as, generally speaking, they are bad, or at best but moderate, it is nearly impossible to refer them to the shells they represent.

The rude figure given by Aldrovandus is large, nearly filling his folio page, but in the external view the interstices of the ribs are represented as striated.

M. Deshayes remarks that Linnæus confounded under his *Chama gigas* the whole of the common and figured species, and that nearly all the writers on the subject have followed his example, so that their synonyms are not to be adopted without correction; and, for that reason, he abstains from citing Schroeter, Gmelin, and others. Chemnitz, he acknowledges, has rendered the synonymy better and more complete, but still there is confusion, because he has mistaken in the works of his predecessors the figures of small species for those of young individuals of *Chama gigas*. Dillwyn, he adds, in his catalogue, has preserved in a single species all that Linnæus comprised; but he has there established varieties which represent with sufficient exactness many of Lamarck's species. M. Deshayes mentions as another source of error that several *Tridacnæ* become gigantic, and their great size has caused many to confound them with the true *gigas*. He quotes Wolfart, who, in his *Natural History of Lower Hesse*, states the occurrence of two valves of a gigantic shell not far from Cassel (p. 39, pl. 10, fig. 1 et 2). The largest of these measured from the umbo to the lower border one foot eight inches, and its width from the anterior to the posterior end was two feet and a half. This shell, M. Deshayes observes, judging from the figure, bore the greatest resemblance to *Tridacna gigas*, and therefore he adds that he can hardly believe it fossil, notwithstanding the passionate fervour of the author, who uses the fact as a weapon to combat imaginary atheists and prove an universal deluge which brought this shell all the way from the East Indian seas, where to his knowledge similar shells were found.

The size and weight of this immense bivalve, the largest and heaviest known,* combined with the beautiful marble-like appearance and whiteness of the inside of the valves, have always caused it to be sought for as an ornament for grotto-work or for garden-fountains; and, indeed, the valve of a large individual forms a very picturesque basin for catching the clear falling water and transmitting it through the deep interstices of its indented edge to the reservoir below. Wolfart's fossils were not improbably the relicts of some antient and long-neglected pleasure-ground. The specimen whose valves serve for holy-water vessels (*Bénitiers*) in the church of Saint Sulpice was presented to Francis I. by the republic of Venice; and Lamarck observes that, large as these are, still larger have been known.

This species can hardly have been the *Tridacna* of Pliny (*Nat. Hist.*, xxxii. 6), which was probably only some overgrown European oyster that required three bites. A fine well-fed Indian giant Tridacna would furnish forth a dish for a dozen. But it is not improbable that the *pedalia* or oysters a foot long, from the Indian Sea, noticed in the preceding sentence of the same book and chapter, may have been *Tridacnæ* of modern authors.

The figure of *Tridacna gigas* given in the *Zoology of the Astrolabe* was designed at Carteret Harbour, New Ireland. The natives brought many very large individuals, whose flesh was abandoned to them, and which they ate raw. The naturalists of the expedition found the species again at Tongataboo, at the Moluccas, at Timor, and at Wagiou. It appeared always to inhabit rather shallow water.

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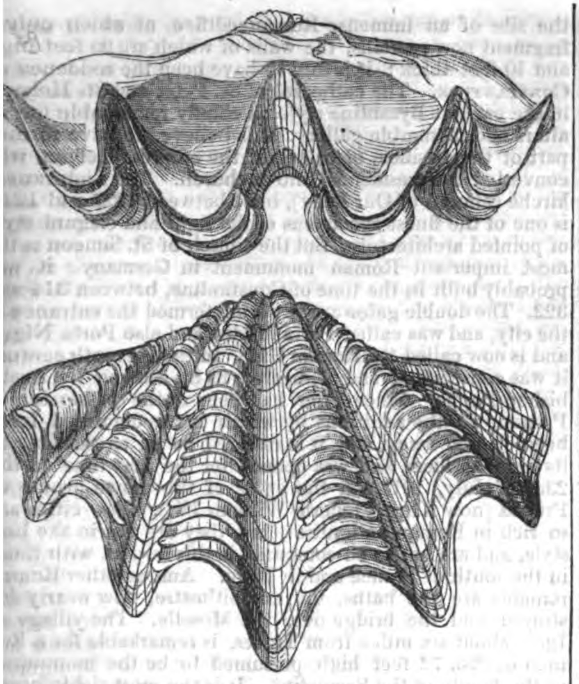
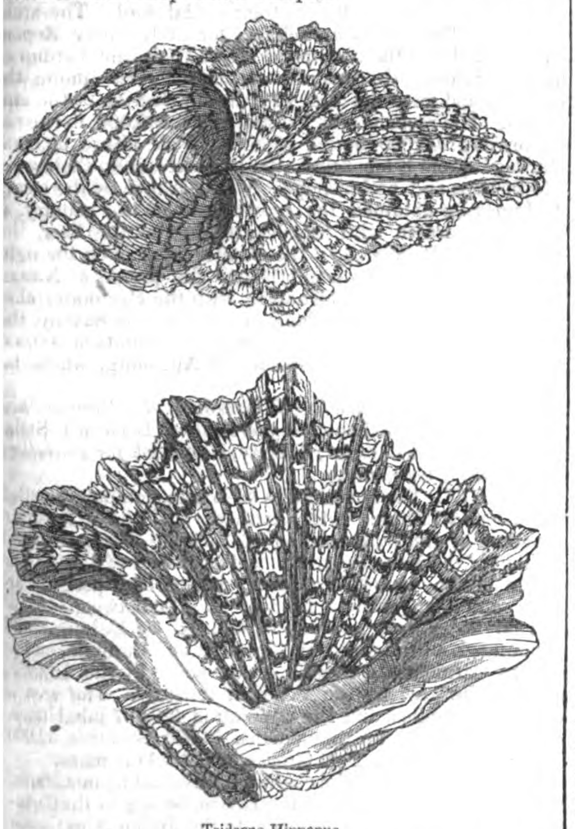
* Five hundred pounds have been recorded as its weight.



Tridacna Gigas.

Of the second division there is but one species known, 'hama hippopus, Linn.; *Hippopus muculatus*, Lam.; 'ridacna maculata, Quoy (*Voyage of the Astrolabe*).

This well-known but beautiful species, now much used in ie ornamental arts for inkstands, &c., has a transversely vate shell, which is of moderate size, ventricose, ribbed, ibsquamous, and white spotted with red or purple; the imule is heart-shaped and oblique.



Tridacna Hippopus.

The naturalists of the 'Voyage of the Astrolabe' found this species at Carteret Harbour, New Ireland, and also at Vanikoro, where they collected specimens left dry on the reefs.

M. Deshayes in his tables makes the number of species of *Tridacna* seven recent, and two fossil (tertiary); and of *Hippopus* one only, recent. In the last edition of Lamarck, the number of recent species of *Tridacna* recorded are six; of *Hippopus*, one.

Fossil Tridacnidæ?

Although M. Deshayes notices two fossil species of *Tridacna* in his tables, but one is recorded in his last edition of Lamarck, published some time afterwards. The volume of Lyell's *Principles* in which the tables appear bears the date of 1833, and the volume of the last edition of Lamarck bears that of 1836. Of the single fossil species there noticed, *Tridacna pustulosa*, Lam., to which the environs of Dives in Normandy is assigned as a locality, M. Deshayes observes, that it does not belong to the genus *Tridacna*, and that the figures of Lister, whom Lamarck quotes, represent very large individuals of *Productus giganteus*, Sow. M. Deshayes moreover remarks, that it is to be presumed that this species was not found at Dives, for it is peculiar to the transition beds of Belgium and England. Mr. G. B. Sowerby ('Genera') states that *Tridacna* is only found recent, and in tropical seas, adding his belief that the East Indian and Australian seas alone supply specimens of it.

In the article *Hippopus*, the last-mentioned author figures (f. 2) a bivalve fossil shell, and after giving the characters of the true *Hippopus*, proceeds as follows:—'There is certainly no genus with whose characters and habits the shells we have represented at *fig.* 2 agree so well as with this: they have been placed in different genera, by Lamarck, which proves that he has entertained some doubts about their proper situation: he has at length united them with several others of similar general characters in *Cardium*; with which however they do not at all accord: formerly he had placed them with *Cardita*, to which indeed they are more nearly related, and, in our view, they prove a manifest affinity between *Cardita* and *Hippopus*. There are only two circumstances in which our *fig.* 2 differs from Lamarck's Hippopus: the first is, that it is rather a longitudinal than a transverse shell; the other is in the muscular impressions, of which it has one, very distinctly marked, but small, and placed close to the umbo behind it: this we cannot trace in *Hippopus maculatus*, but it should be remarked that in many specimens of this shell that we have examined, it has been extremely difficult to trace the muscular impressions, as well as the impression of the muscle of attachment of the mantle: in fact the whole forms but one impression, surrounding the edge at a distance, and becoming larger towards the centre; and in one specimen we think we can discover the corresponding impression to the one mentioned in *fig.* 2. The only recent species known is the *Hippopus maculatus*. For the reasons given above, we do not hesitate at naming the fossil shell *fig.* 2, *Hippopus avicularis*: there are two or three other fossil species resembling this in general form; such is the *H. cymbularis*, *Cardium cymbulare*, Lam. All these fossils are found near Paris.'

In the last edition of Lamarck, by M. Deshayes, no fossil *Hippopus* is recorded.

TRIDACOPHYLLIA, a genus of lamelliferous corals, separated from Madrepora, Linn. [Madrephylliæ.]

TRIDENT (*tridens*, τρίαινα) is any instrument of the form of a fork, with three prongs; instruments of this kind were used by the antients, as among ourselves, for various purposes. In mythology the trident is the attribute of several marine divinities, such as Nereus (Virg., *Æn.*, ii. 418) and the Tritons (Cicero, *De Nat. Deor.*, ii. 35), but above all of Neptune (Poseidon). The trident in these cases is the same as the sceptre with other gods, the emblem of the power of these gods of the waters. The antients regarded earthquakes as arising from the sea, or, as they expressed it, as the work of Neptune, who effected them by his mighty trident, whence Homer frequently calls him the 'shaker of the earth,' and whenever the god is represented as producing any convulsion of the earth or the sea, the trident is always mentioned. (Hom., *Odyss.*, iv. 506; Claudian, *De Rapt. Pros.*, ii. 179.)

TRIENTA'LIS, the name of a genus of plants belonging to the natural order Primulaceæ. In British botany this genus is somewhat conspicuous, as it is the only one which belongs to the Linnæan class Heptandria. The parts of the fructification are remarkable for being arranged according to the number seven. The calyx consists of 7 sepals; the corolla is monopetalous with 7 deep segments; the capsule is 1-celled, composed of 7 valves, enclosing an indefinite number of seeds, which are seated on a fleshy central free receptacle; the seeds are covered with a reticulated membrane.

The only British species of this genus is the *T. Europæa*, the European chick-weed, Winter-green. It is distinguished from the American species by possessing elliptical instead of lanceolate leaves. This plant is rare in England, being only occasionally met with in woods in the northern counties; it is however abundant in many parts of the Highlands of Scotland. It is an elegant plant, having a tuberous root and a solitary simple stem 4 or 5 inches high, the extremity of which is crowned with a tuft of nearly sessile leaves; among these are numerous axillary flower-stalks, each having a very pretty and delicate white flower with yellowish or pinkish anthers: the *T. Europæa* occurs in the north-west of America and in Siberia, as well as in Great Britain.

T. Americana, the American chick-weed, winter-green, has lanceolate leaves. It is found in mountainous districts in Canada and Virginia.

TRIER (in French and English, *Treves*) is one of the five governments of Rhenish Prussia (*Die Rhein Provinz*). It is bounded on the north by the government of Aix-la-Chapelle, on the east by that of Coblentz, on the west by the principality of Birkenfeld and the Bavarian circle of the Rhine, on the south and south-west by France, and on the west by Belgium. It is divided into twelve circles, the area is 2700 square miles, and the population 446,796, of whom about 400,000 are Roman Catholics, 40,000 Protestants, and 7000 Jews. The face of the country is hilly, with a considerable extent of forest and pasture land, but not much that is adapted to tillage. There are mines of iron, lead, calamine, copper, and coal. Some wine is produced in sheltered situations on the banks of the Moselle. The manufactures are of various kinds, but none of any considerable importance.

TRIER (*Treves*), the capital of the government and circle of the same name, is situated in 49° 46′ N. lat. and 6° 38′ E. long., on the right bank of the Moselle, over which there is a stone bridge of eight arches, 690 feet long and 24 feet wide. It lies in a valley of extraordinary fertility, bounded by low hills covered with vines. This city is undoubtedly one of the oldest cities in Germany, without giving credit to the hyperbolical inscription on the wall of the red house, formerly the town-hall, which asserts that Treves was built 1300 years before Rome. When Julius Cæsar was in Gaul, the Treviri were a powerful people. The chief city of the Treviri was afterwards called Augusta. In later times it was the residence of the emperors Constantius, Constantine the Great, Julian, Valentinian, Valens, Gratian, and Theodosius; and was so eminent for its commerce, manufactures, wealth, and extent, that Ausonius calls it the second metropolis of the empire. It was nearly annihilated by the Huns, the Goths, and the Vandals, yet subsequently almost recovered its antient splendour under the archbishops of Treves, some of whom maintained large armies, which they led to the field in person, and greatly enlarged their dominions, so that they obtained considerable political influence in Germany.

This city was taken by the duke of Marlborough in 1704, and during the wars of the French revolution suffered, like other German cities, by having its churches and convents plundered of their wealth, their buildings being converted into stables or warehouses. Under the government of Prussia, to which it was assigned by the congress of Vienna, it is gradually recovering. The population (exclusive of the garrison and the suburbs) is 14,500. This seems too little for the extent of the city, which is an oblong parallelogram a mile and a half in length, but these limits include several large gardens. The streets are irregular, and for the most part narrow: there are nine suburbs, and eleven gates. It is the seat of the government, of a bishop and chapter, and of several tribunals and public offices. The university, founded in 1454, and greatly extended in 1722, was converted by the French into a central school, and is now called a gymnasium: it has a library of above 70,000 volumes and 2000 MSS., among which is a Codex Aureus of the four gospels. Among the public buildings the following are the most worthy of notice:—The antient electoral palace, now converted into barracks: it stands partly on the site of an immense Roman edifice, of which only fragment now remains, the walls of which are 90 feet hi and 10 feet thick; it is said to have been the residence CONSTANTINE. The cathedral of St. Peter and St. Helena in the earliest Byzantine style, is chiefly remarkable for altars and its marble gallery. It is believed to have form part of the basilica, or palace of the empress Helena, w converted her residence into a church. The Liebfrau kirche (church of Our Lady), built between 1227 and 12 is one of the finest specimens of the light and elegant st of pointed architecture. But the church of St. Simeon is the most important Roman monument in Germany: it was probably built in the time of Constantine, between 314 and 322. The double gateway, or portal, formed the entrance the city, and was called Porta Martis, and also Porta Ni and is now called the Roman Gate. In the eleventh cent it was consecrated and dedicated to St. Simeon by Ar bishop Poppo. Since Trier has been in the possession Prussia, all the additions by which it was deformed ha been cleared away, and it is restored as far as possible its original form, and was opened for the first time on t 23rd of July, 1817, on the entry of the crown-prince Prussia (now King Frederic William IV.). Few cities so rich in Roman antiquities, but they are not in the b style, and are not to be compared in this respect with the in the south of France and in Italy. Among other Roman remains are the baths, the amphitheatre, now nearly destroyed, and the bridge over the Moselle. The village Igel, about six miles from Treves, is remarkable for a Roman obelisk 72 feet high, presumed to be the monument of the family of the Secundini. It is the most richly ornamented Roman monument in all Germany. Treves though not a manufacturing town, properly speaking, has however some manufactures of cloth, woollens, porcelain hats, tobacco, paper-hangings, soap, several breweries and distilleries, and a very considerable trade in wine, timber coals, and corn.

The area of the antient archbishopric and electorate was 2300 square miles, with nearly 300,000 inhabitants, besides several counties, lordships, abbeys, and convents which recognised the archbishop as their feudal lord. The archbishop of Treves was archchancellor of the holy Roman empire, and had the bishops of Metz, Toul, and Verdun his suffragans. He was the second in rank among the electors, and gave the first vote at the election of the emperors. His revenue was estimated at 300,000 florins money and 200,000 florins in kind, in all above 50,0 sterling. From Eucherius to the last archbishop there were 114 bishops and archbishops. When France by the treaty of Luneville obtained the greater part of the country, was incorporated with the departments of the Saar, the Rhine, and the Moselle; the smaller portion on the right bank of the Rhine was allotted to the prince of Nassau Weilburg, and the archbishopric, with the electorate, abolished. Clemens Wenceslaus, of the house of Saxony, the last elector, received as an indemnity an annuity of 300,0 florins, and the episcopal palace at Augsburg, where he died in 1812.

(Müller, *Geographisches Wörterbuch der Preussischen Monarchie*; Brockhaus, *Conversations Lexicon*; Stein *Geographisches Lexicon*; Murray, *Handbook for Travellers in Northern Germany*.)

TRIESTE. The government of Trieste, commonly called the Illyrian Littoral, is the southern half of the Austrian kingdom of Illyria, consisting of Austrian Friaul, a small portion of the Venetian territory, the district of Trieste, the whole of the peninsula of Istria, the southern part of Carniola, and the Quarnero islands. It lies between 44° 2 and 46° 25′ N. lat., and 13° 15′ and 14° 45′ E. long.; and is bounded on the north by Carinthia and Carniola, on the east by Carniola and Croatia, on the south by the Adriatic, and on the west by the Venetian territory. The area is 4055 square miles, and the population 426,537 inhabitants, of whom 350,650 are Slavonians, 19,000 Germans, 52,00 Italians, 2500 Jews, 2300 Greeks, and 40 Armenians.

The greater part of the country is traversed by mountains, which, on the west side of the Isonzo, belong to the Carinthian Alps, and on the east side to the Julian Alps; some of these mountains are 6800 feet high. They are all calcareous. There are some remarkable caverns or grottoes with beautiful stalactites. On the whole the country is not well watered. The most considerable river is the Isonzo, which flows through the two governments of which e kingdom is composed. In the latter part of its course, Gradiska, where it becomes navigable, it changes its me to Sdoba, is nearly 2000 paces broad at a short dis- nce above its mouth, and empties itself by the lagoon occa di Sdoba) into the Adriatic, south of Monfalcone. her rivers are the Idria, the Timavo, and the Quieto, but eir course is short, and they are nearly dry in the summer. ere are several waterfalls in the mountainous part of the ovince, of which the celebrated fall at Podmenz is the ost worthy of notice. In some parts of the sea-coast ere are many marshes, the exhalations from which render e neighbourhood unhealthy. In the northern part of the rcle of Göritz the climate is nearly the same as in the lpine regions of Germany, whereas on the sea-coast and the island it is mild and quite Italian. The spring sets suddenly at the end of January, and may be said to last r a few days only, the heat soon becoming very great. he winds often rage with great fury in this province: ey are the Sirocco, which blows from Africa at the nd of autumn, and is always attended with torrents of in; and the Bora, a cold north-east wind, which frequently erturns loaded waggons on the high road, and compels e ships on the coast to stand out to sea: it brings cold y weather. Some parts of the country are sterile, but hers are fruitful, and produce vines, olives, and in general the fruits of southern Europe; but the quantity of rn grown is not considerable. There is a good breed of eep. The minerals are limestone, numerous varieties marble (some of which contain interesting organic mains), beautiful spars, slate, sandstone, and coals. There e silver and iron ores in some places, but they are not orked, for want of funds. Salt is obtained from the a-water by evaporation in the sun. The pastures on the xtensive sea-coast are very productive. The government divided into the four circles of Trieste, Fiume, Göritz, nd Carlstadt. [Illyria; Istria; Göritz.]

TRIESTE (*Tirest*), once a Roman colony (called by Pliny nd Pomponius Mela *Tergeste*), is now a flourishing com- ercial city and seaport, the capital of the government of he same name in the kingdom of Illyria. It is situated in 5° 48′ N. lat. and 13° 38′ E. long., at the north-western xtremity of the Gulf of Venice. It consists of two parts; he old town, standing on a hill with a castle on the sum- it, and the new town called Theresienstadt, which is built n level ground extending to the sea-side. The old town as narrow, crooked, dirty streets, especially in the old Jews' uarter. The new town however forms a regular square vith broad streets crossing each other at right angles, and ome canals, one of which, called the Great Canal, presents very animated appearance. There are 31 squares or market- laces, of which the Theresienplatz and Joseph's Platz in he new town are the handsomest. There are 9 churches, mong which are 1 Lutheran, 1 Calvinist, 1 Greek, 1 Oriental Greek, and 1 Servian; besides other great public buildings, uch as St. Peter's church, the ancient cathedral, the Synagogue, and the noble Exchange: the city contains many very large and handsome private houses. In the year 1719 he emperor Charles VI. declared it a free port. At that time there were scarcely 8000 inhabitants; the privileges of the place were extended by the empress Maria Theresa, o that all goods, with very few exceptions, can be imported duty free. The consequence has been that the population is now above 50,000, and continues annually to increase, and Trieste is now the most important and wealthy commercial city in the Austrian dominions. Consuls of almost every nation in Europe reside there: it has 19 banks and insurance companies, 1000 merchants, and 700 brokers. The commerce of Trieste was much increased by the commercial treaty concluded with Greece in 1835, and by the new institution of the Austrian Lloyd's, which is supported by the government. The number of ships engaged in the commerce of Trieste is so constantly being augmented, that it cannot be exactly stated; of large merchantmen there are about 1500 arrivals of all nations, and the number of arrivals of coasting vessels is not less than 8000. Several steamers ply between Trieste and Venice, and the society of the Austrian Lloyd's has a regular communication by steamers with Greece and Egypt. The harbour is defended by a strong battery on the new mole, which was formed to shelter it from the south, but is not fully protected against the Bora. There are two lazarettos near the harbour, where ships from suspected places perform quarantine. Among the manufactories, that of oil-soap deserves mention as being the largest in Europe: there are two other soap manufactories, and several of leather, rosoglio, and wax.

Trieste is a seaport for a very large tract of country, the south of Germany, the Illyrian and part of the Slavonian provinces, in short, for the whole of the Austrian territories from the Tyrol to Transylvania. Among the exports are the productions of the mines of Idria, those of Hungary, linens, tobacco, and woollens from different parts of the Austrian dominions, and printed calicoes from Switzerland. The imports are cotton from Egypt; hides, raisins, silks, rice and oil from the Levant; wheat from Odessa, and all kinds of tropical and colonial produce from the West Indies and Brazil.

Ship-building is carried on to a great extent, and the ship-builders of Trieste are so much esteemed for their skill, that designs for vessels of various kinds are sent as models to many foreign ports.

Among the literary establishments the Scientific and Nautical School, with 16 professors, the public library, the Gabinetto di Minerva with a library and museum, and the gymnasium, are the principal. The hills surrounding the city are adorned with beautiful country-seats and gardens. About 70 years ago these hills were naked and desolate, but mould has been brought at a great expense by sea from Istria, and this barren tract gradually transformed into a paradise. After the treaty of Vienna in 1809, Trieste with its territory was annexed by Napoleon to Illyria. In 1814 it returned to the dominion of Austria, and in 1818 received the title of 'Città fedelissima.'

(*Oesterreichische National Encyclopädie*; Blumenbach, *Die Oesterreichische Monarchie*; Jenny, *Handbuch für Reisende in Oesterreich*; Brockhaus, *Conversations Lexicon*.)

TRIEWALD, MARTIN, an eminent Swedish engineer and mathematician, was born at Stockholm in 1691, and educated in the German school of that city. Being intended for a commercial life, he visited England on the completion of his studies, to improve himself in such branches of knowledge as might prove useful in his future career; but having met with some disappointments, and seeing little prospect of success, he determined to embark for some distant part of the world. He was deterred from so doing by forming an intimacy with Baron Fabricius, the Holstein minister, who took him into his service as a secretary,—an engagement which led to his becoming better known, and gave him an opportunity of acquiring the friendship of several eminent persons, among whom was Sir Isaac Newton. Triewald was subsequently engaged by the proprietor of some coal-pits near Newcastle, to superintend the management of the colliery-works, a situation for which he was qualified by his studies while in London, where he had attended the lectures of Dr. Desaguliers on natural philosophy. In this situation Triewald devoted his attention principally to mechanics, and studied diligently those branches of the mathematics which are most useful to an engineer. He had never before seen a steam-engine; but he very soon made himself acquainted with the construction of that machine, and introduced some improvements in it.

In 1726, after an absence of ten years, he returned to his native country, where he constructed a steam-engine, and read lectures on natural philosophy, which he illustrated by experiments. These lectures were well received, and recommended Triewald to the notice of the king and of the states, who conferred upon him an annual pension, with the title of director of machinery. He next turned his attention to the improvement of the iron and steel works of Sweden, and endeavoured to introduce superior processes in the manufacture of iron. His zeal and diligence in this and other similar pursuits procured him a commission as captain of engineers and inspector of fortifications; and while acting in that capacity he invented various machines, which are still, or were, not many years since, preserved in the Academy of Sciences at Stockholm. Several similar memorials of his talent were also deposited with the Academy of Lund. Among the machines to which he directed his attention with a view to the introduction of improvements was the diving-bell, on the use of which he wrote a treatise, which was published at Stockholm in 1741. The construction of his diving-bell is described under Submarine Descent, vol. xxiii., p. 191. He invented a ventilator for the expulsion of foul air from ships, &c., for which he received honorary rewards from the king of Sweden and from the king of France; and he attended to agriculture and the naturalization of foreign plants

Triewald was one of the earliest members and promoters of the Academy of Stockholm; in 1729 he was elected a member of the Scientific Society at Upsal, and he received similar honours from several other learned bodies, among which was the Royal Society of London. He wrote several papers in the 'Memoirs of the Academy of Stockholm' for 1739, 1740, and 1747; and also made communications, of which a list is given in the work referred to below, to the English 'Philosophical Transactions.' Triewald died suddenly in 1741.

(Aikin's *General Biography.*)

TRIFO'LIUM (*τρίφυλλον*), the name of an extensive genus of plants belonging to the curvembryose division and to the papilionaceous tribe of the natural order Leguminosæ. This genus, which has obtained its Latin as well as its French and English designations, Trefle and Trefoil, from its leaves possessing three segments, is one of the most extensive in the vegetable kingdom. Don, in Miller's 'Dictionary,' enumerates 165 species. They are principally inhabitants of temperate climates, and are found in all quarters of the globe. This genus has been somewhat difficult to define, and species have been admitted into it or rejected according to the views botanists have taken of its true character. Linnæus gave an extended definition of the genus, which embraced many of the genera of other botanists. Some of these have been restored by recent systematists, and the genus is now defined with the following characters:—the calyx tubular, 5-cleft; corolla remaining after decay; carina obtuse; stamens diadelphous, more or less connate with the petals, the filaments dilated above; the style smooth; legume ovate, with one or two seeds, sometimes oblong, with three or four seeds, and included within the decaying calyx and corolla. All the species are herbs, the leaves are mostly divided into three segments or foliolules; sometimes they are seen with four or five. The flowers are disposed in dense heads or spikes, and are of a purple white or cream-colour. De Candolle has arranged the numerous species of this genus under seven sections, the characters of which are founded principally on the inflorescence and on the form of the calyx, or of the corolla combined with it. We shall here select some of the most useful and remarkable of the species as illustrations of the genus.

The first section contains Trefoils with spicate flowers; oblong bractless spikes; calyx very villous, and not inflated after flowering.

Trifolium incarnatum, Flesh-coloured Trefoil, or Scarlet Clover. The spikes of flowers are at first ovate, at length cylindrical, solitary, and naked at the base: the calyx 10-nerved and hairy, with unequal awl-shaped acute teeth longer than the tube and shorter than the corolla; stipules ovate and obtuse; leaflets obovate, crenated, villous; stem erect. This species is a native of the south of Europe, in damp meadows.

It is an annual of rapid growth, so that in southern climates it may be sown in summer after an early crop of corn, and fed off or cut before winter. It will stand the winter well if sown later, and give very early feed in spring. It produces a great abundance of seed if allowed to ripen; and on its introduction into England great profits were made by the first cultivators of it, by growing it entirely for seed. The price however soon was so greatly reduced by abundant production, that it did not repay the exhaustion of the soil consequent on the ripening of the seed. It is however a valuable addition to the plants usually raised for fodder, and fills up an interval between other plants by its very early and rapid vegetation. The mode of sowing the Trifolium incarnatum is simple and attended with very little expense. In the month of August, as soon as the crops of corn have been reaped, the stubble is well harrowed to raise a small portion of mould; the trifolium is then sown at the rate of four bushels of the seed, in the husk, per acre. There is a double advantage in sowing it in this manner: it saves the thrashing required to separate the seed, as a very slight beating will separate the florets of the head or spike sufficiently to sow them; and it vegetates sooner from the moisture retained in the husk which envelops the seed: a bush-harrow is drawn over the land to cover the seed, and it is rolled with a barley-roller, if the land be of a firm nature, or with a heavier roller if it be a loose soil. Thus the Trifolium will vegetate much more certainly than if the land had been regularly ploughed and harrowed, which would have loosened it too much.

It is not advantageous to let the Trifolium incarnatum be cut for hay. Its stem then has acquired a hard woody nature, and it makes very inferior hay. Its principal use is to feed off with ewes and lambs before other food is ready in spring, or to cut it green for horses and cattle. The ground may be ploughed and prepared for spring crops as early as is required; and thus the Trifolium in no way interferes with the usual rotations. When the common broad clover has failed from any cause, and bare patches are left in the fields in autumn, the Trifolium incarnatum may be sown there with advantage; it will overtake the clover sown in the preceding spring and fill up the deficiency. In this case a mixture of Trifolium incarnatum and Italian rye-grass (*Lolium perenne Italicum*) has been found very useful. If the Trifolium is sown early in spring, it will produce very good feed in a few months, and the land may afterwards be sown with turnips without any loss of time. It must be recollected that the Trifolium incarnatum is a *catch crop*, that is, one which comes in between two regular crops, without interfering with the rotation, and that it costs little more than the seed, which is easily raised, or may be bought at a very moderate rate. All cattle are fond of it in a young state, and it comes in a fortnight earlier than lucern, which is one of the first of the artificial grasses fit for cutting in spring. The great expectations raised at its first introduction not having been fully realized, this plant has rather fallen in the estimation of farmers; but if it is not so valuable as the broad clover in a regular rotation, it ought not to be despised as a subsidiary crop. When the season has prevented the sowing of spring corn, it may be advantageous to sow the Trifolium incarnatum together with Italian rye-grass, as soon as the land is clear of root-weeds. They may *be fed* off with sheep early in autumn, and the land, being manured or not, as may be thought necessary, may be ploughed and sown with wheat. Thus the Trifolium and rye-grass will come in the place of a clean fallow; and the ground having been covered during the heat of the summer and manured by the sheep folded on it, will be much improved for the wheat crop. It must be remembered that the Trifolium requires a solid bottom, and that the heavy roller should not be spared before it is sown. This is chiefly to be recommended on soils which do not suit spring tares, and as a substitute for these; for under favourable circumstances the tares will produce the greatest quantity of food. It is however useful to have a choice of different green crops, from which may be selected those which offer the greatest prospect of success, when the season, the soil, and other circumstances are taken into consideration.

T. arvense, Hare's-foot Trefoil. The stem erect, branched or simple; heads of flowers very hairy, soft, nearly cylindrical, terminal stalked; the teeth of the calyx longer than the corolla, setaceous and somewhat spreading; stipules ovato-acuminate; leaflets lanceolate. obtuse. This plant is a native of Europe, and is abundant in cornfields and dry pastures in Great Britain. Its soft hairy subcylindrical heads or spikes give it a very remarkable character.

The second section contains Trefoils with flowers disposed in ovato-conical heads, the calyx not inflated after flowering. None of the species belonging to this section are cultivated either on account of their utility or beauty. Two of them, the *T. striatum* and *T. scabrum*, are natives of Britain. The first has pale-red flowers, the second white flowers.

The third section have their flowers disposed in oval pedunculated or sessile, usually bracteate heads: the calyx is villous and not inflated.

T. maritimum, Sea-side or Teasel-headed Trefoil. The heads are sessile and terminal; the teeth of the calyx broad, acuminate, rigid, the lower one much longer and larger than the rest, shorter than the claws of the petals, all of them at length enlarged and spreading; stipules lanceolate-subulate; leaflets oblongo-obovate; stem ascending. It is a native of Europe, in salt marshes and meadows near the sea-side. It is found on the east and south coasts of Britain.

T. Alexandrinum, Alexandrian Trefoil, or Clover. The whole plant is smooth; the stem is thick ascending; leafets ovato-elliptic, somewhat toothed; stipules narrow, erved, equal in length to the petiole; calyx hardly ribbed, ilose, with the segments setaceous and nearly equal, the wo upper ones joined at the base, much shorter than the onopetalous corolla; seeds ovate, compressed; flowers ale-yellow. It is a native of Egypt, about Alexandria. t is the only Trefoil that is cultivated in Egypt, where it extensively used as fodder for cattle. When it is sown bove the influence of the waters of the Nile, it is watered y the method of artificial irrigation employed by the gyptians.

T. medium, Meadow-Trefoil, Marl-Clover, or Cow-grass. he heads of the flower are lax, subglobose, solitary, terinal; the teeth of the calyx are setaceous, the lower one onger than the rest, about equal to the tube of the orolla; stipules lanceolate, acuminate; leaflets ellipical; stems branched, zigzag. It is a frequent plant in he pastures of Britain, where it can be recognised by its igzag stem, from which circumstance it is sometimes alled Zigzag Trefoil. This plant is sometimes cultivated the place of *T. pratense*, as it is said to flourish better n cold tenacious soils, as well as some light lands, lthough its produce of nutritive matter on good soils is ot, according to Mr. Sinclair, more than half as much as f that plant.

T. pratense, Common Purple Trefoil, or Red Clover. he stem is ascending; the leaflets are oval or obcordate; he heads of flowers are dense and ovate; the teeth of the alyx are setaceous, the lower one longer than the rest; tipules ovate, bristle-pointed. This plant has reddishurple flowers, and is frequent in meadows and pastures, here it blooms all through the summer. The leaves are sually marked with a white subsagittate mark in the entre. This species is considered on the whole as the est for cultivation as fodder, although there are cases in hich other species are preferred. [CLOVER.]

The fourth section embraces the species with capitate lowers; the heads globose and sessile, or pedunculate; he flowers usually become deflexed as they increase in ge; the calyx is not inflated.

T. repens, White Trefoil, White or Dutch Clover. It as umbellate globose heads; legumes with four seeds; eeth of the calyx unequal; the leaflets obcordate, serruate; the stem creeping. This plant is very abundant in he meadows and pastures of Britain, and, next to the *T. ratense*, is valued and cultivated most of any of the cloers. According to the soil on which it is grown, and the limate to which it is exposed, this plant assumes great arieties; and a number of these have been named, and ome have been elevated to the rank of species. This lant is said to be the *Shamrock* of Ireland, and is worn y the Irish as the badge of their country. The original hamrock does not appear to have been a clover, but the Oxalis acetosella, which has also leaves with three diviions. Leaves of this character have, from a very remote period, been regarded with superstitious reverence.

> 'The holy trefoil's charm'

was supposed to be very 'noisome to witches,' and to keep hose who wore it from the influence of evil spirits of all kinds.

The *T. suffocatum* and *glomeratum* are British species belonging to this section.

The fifth section have their flowers arranged in dense heads; the under lip of the calyx remains unchanged, but the upper one, after flowering, becomes inflated, and forms an arch over the legume. It includes the *T. subterraneum* and *fragiferum*, both of them British species: the first has white or pale-red flowers; the second has rose-coloured flowers, and, when in seed, resembles a strawberry.

The sixth section has large flowers with coriaceous permanent petals, of a red, white, or yellow colour. To this section belongs the *T. alpinum*, which is a small plant with large purple flowers. It inhabits the higher Alps. The roots have a sweet taste, very closely resembling those of liquorice, for which they are often substituted.

The last section have their flowers disposed in an ovate, pedunculate head, with scarious yellow petals, having the vexillum deflexed.

T. procumbens, Yellow Clover, or Hop Trefoil. It has heads broadly oval, many-flowered, dense, standard at length deflexed, furrowed; leaves stalked; leaflets obcordate, the central one stalked. It is frequent in dry pastures and on the borders of fields. The heads of flowers very much resemble the hop, hence the name. This plant is frequently cultivated with the white clover for fodder.

There is another British species very nearly resembling *T. procumbens*, the *T. filiforme*, Lesser Yellow Trefoil, from which it may be distinguished by its large, dense, hop-like flowers. Cattle are very fond of the smaller yellow trefoil, but its produce is too small to answer for cultivation as fodder.

Many of the trefoils may be introduced into the garden: they require little care, and will grow inalmost any garden soil. Those which are perennial may be increased by dividing their roots and planting them out in the spring; or both perennial and annual kinds may be raised from seed, which may be sown in an open border.

(Don's Miller, vol. ii.; Sinclair's *Hortus Gramineus Woburnensis*; Koch's *Flora Germanica*; Burnett's *Outlines of Botany*; Hooker's *British Flora*.)

TRIFO'RIUM, a term of uncertain origin, applied to the upper galleries formed by small open arches above those dividing the nave from the side-aisles of a church, and beneath the clerestory windows, this intermediate tier being within the sloping roof over the aisles. While they serve to economise material, and to relieve the larger arches below from the pressure of too much solid wall, they also serve to fill up what would else be a blank space between the clerestory and aisles, and that in such manner as to produce lightness, variety, and contrast of effect. These galleries, which in this country are sometimes called 'Nunneries,' but in Germany the 'Männerchor,' are not confined to the nave, but continued in the transepts, so as to afford a passage almost entirely round the upper part of the building. In general the triforium is very shallow or narrow, and the arches in front of it small and low; and of these last there are two, three, or even six, over each of the larger arches separating the nave from the aisles. There are however very great differences in these respects even in buildings of the same period and style. In some instances the triforium is very lofty and open, as in the Abbaye aux Hommes, Caen, and in the choir of Bayeux Cathedral, although the nave of the same edifice offers an example directly the reverse, the triforium consisting there of a range of very low and small arches; while the clerestory windows are remarkably large and lofty, much larger in fact than the pier-arches between the nave and aisles. In the Norman naves of some of our cathedrals the triforium arches are as wide and nearly as high as those of the aisles; and the triforium itself is so spacious as to form an upper aisle, lighted, like the lower one, with windows. Norwich is an example of this kind, as is likewise Peterborough, except that in the latter the large triforium arches corresponding with those below are subdivided into two lesser ones with a column between them. At Gloucester, on the contrary (also Norman), the triforium arches are low and small, being divided at first into two, each of which is again similarly subdivided, so as to make four openings over each of the large arches below. In the nave of Wells Cathedral the triforium consists of an uninterrupted range of small arches of peculiar character, in which the openings are very narrow in proportion to the solid parts or moulded piers between them. There is indeed so much variety of design, character, and combination, as regards the three divisions or stories of pier-arches, triforium, and clerestory, that a comparison of the internal elevations of different Gothic edifices, in that respect, would form a highly interesting study.

TRIGLO'CHIN (τριγλώχιν, three-pointed), the name of a genus of plants belonging to the natural order Juncaginaceæ. It has a perianth, with six concave deciduous leaves, three outside and three inside; the anthers are sessile, lodged in the leaves of the perianth, and have their backs turned towards the ovary; the capsules are from three to six in number, are 1-seeded, and united by a longitudinal receptacle, from which they separate at the base. The genus has several species: they are inhabitants of marshes, sides of rivers, ditches, and wet meadows. Two only of the species inhabit Europe, and these are found in Great Britain.

T. palustre, the Marsh Arrow-grass, has a 3-celled fruit, of a linear form, attenuated towards the base. When bruised, the leaves give out a fetid smell. In dry seasons the roots frequently become nodulose, presenting something of the appearance of a scorpion's tail. It grows in damp marshy places, and is very abundant in many parts of this country.

T. maritimum, Sea-side Arrow-grass, has a 6-celled ovate fruit. It is a much larger and stouter plant than the last, and is always found growing near the sea or in marshes under the influence of salt-water. It is a native of North America as well as Europe. This plant has a salt taste, and cattle are said to eat of it with avidity.

TRIGLYPH. [CIVIL ARCHITECTURE, p. 218.]

TRIGONELLA (from *τρι*, three, and *γωνια*, an angle), the name of a genus of plants belonging to the curvembryose division and to the papilionaceous tribe of the natural order Leguminosæ. It consists of strong scented herbs with trifoliate leaves; the calyx is 5-parted and 5-toothed; the keel of the corolla is obtuse; the stamens are diadelphous; the style is smooth; the fruit a legume, unilocular, compressed, linear, and containing six or more seeds. The known species of this genus are upwards of thirty. Only five of them are European, and only one is found in Great Britain.

T. Fœnum-Græcum, the common Fenugreek, has the stem erect, simple: the leaflets obovate, slightly toothed; the stipules lanceolate, falcate, entire; the calyx hairy; the teeth awl-shaped, of the length of the tube; the legume is falcate, many-seeded; the seeds large, ovate, wrinkled from dots; radicle of cotyledons prominent. This plant is a native of the south of Europe. Dr. Sibthorp found it in abundance on the shores of Asia Minor. This plant, or one of the genus, was known to the Greeks under the name *ἡδυσάρον*, and to the Romans as Fœnum Græcum, Greek hay, and the seed was held in great esteem as a medicine. The scent of the seeds is very strong, and it was undoubtedly this circumstance that recommended them to notice as medicinal agents. The peculiar smell of the seeds is given to alcohol in which they are digested; and when they are boiled in water they yield a ropy mucilaginous decoction. The strong scent is probably due to an essential oil contained in the testa of the seeds; whilst the mucilage they yield to water is contained in the albumen of the seed. They are now seldom used in medicine, and when they are employed it is only as an external remedy in the form of fomentation or poultice. They are still used by grooms and farmers as a medicine for horses. In some parts of the south of Germany this plant is extensively cultivated as fodder for horses and sheep. It does not however appear adapted for the climate of Britain, on account of the uncertainty of the weather. Bischoff says, that in Egypt a food is prepared with milk and fenugreek seeds, which has the property of making corpulent; and that in that country, where this quality is considered a beauty, the ladies are in the habit of using it as a diet.

T. ornithopodioides, the Bird's-foot Trefoil, has a decumbent stem; the leaflets toothed at the extremity, the flowers three together; the legumes naked, twice as long as the calyx, with about eight seeds in each. This is the Trifolium ornithopodioides of Linnæus, but has been placed in the present genus by De Candolle and Lindley, although perhaps its proper position is in neither genus. It is found in Great Britain, in dry sandy pastures, but not very commonly.

T. elatior, Tall Fenugreek, has an erect stem; stipules lanceolate, toothed; legumes racemose, pendulous, linear, slightly curved, obtuse, longer than the leaves. Dr. Sibthorp found this plant in Asia Minor and the isle of Cyprus, and Sir J. E. Smith is of opinion that it is the λῶτος ἄγριος of Dioscorides. He observes, that this plant is 'well worth the notice of the farmer, for experiment at least, on account of its luxuriant growth, and the qualities of many plants to which it is related; as they may possibly be found in great perfection in this species.'

T. esculenta, Esculent Trigonella, has pedunculated racemes, with the peduncle longer than the leaf; the legumes are linear, somewhat curved, crowded together and pedicillate. This plant is a native of some parts of the East Indies, where its legumes are eaten by the natives as food.

None of the species are remarkable for beauty, and consequently are seldom found in gardens. When it is desirable to cultivate them, seeds of the annuals may be sown in open borders in the spring, or the roots of the perennial species may be divided and planted out.

TRIGO'NIA. [TRIGONIDÆ.]

TRIGO'NIDÆ, a family of conchiferous mollusks, the type of which is the genus *Trigonia*, Brug.; and which Lamarck, who makes it consist of that genus and of *Castalia*, places between his *Arcacées* and the *Naiades*.

Cuvier arranges the genus *Trigonia* under the great genus *Arca*, Linn., and next to *Nucula*, which last genus stands at the end of Lamarck's *Arcacées*.

M. de Blainville makes *Trigonia* the last genus of his 7th family, *Camacea*, placing it next to *Isocardium*.

M. Rang adopts the arrangement of Cuvier.

Mr. J. E. Gray arranges the *Trigoniadæ*, consisting of the genus *Trigonia* only, between the *Mycetopidæ* and the *Arcadæ*, under his third order, *Goniopoda*.

Mr. Swainson places *Trigonia* at the end of the *Arcadæ*, next to the genus *Byssoarca*.

Bruguière established this genus upon a fossil shell, having only seen the hinge of one of the valves, that which has two teeth only; and Lamarck observes that Bruguière was not aware that the left valve has four teeth disposed in pairs for the reception of the two opposites. The only recent species hitherto known was first brought home by Péron from New Holland.

With reference to Lamarck's family of the *Trigoniæ*, M. Deshayes, in the last edition of the *Animaux sans Vertèbres*, remarks, that it was framed before the animal of *Trigonia* was known, and before the numerous and wonderful modifications that appear in the different species of *Unio* in various localities had been detected. If those observations had been known to Lamarck, he would doubtless have adhered to his former opinion, which led him to unite the genus *Trigonia* to the *Arcacées*, and to place *Castalia* among the *Naiades*. M. Deshayes goes on to observe, that to this first opinion of Lamarck we are forced now to return; to seize at least the slight shades which separate the *Trigoniæ* from the *Nuculæ*, and to form of the first-named genus a separate family; for the *Castaliæ* have so many relations with the *Uniones*, that it is *impossible* to separate the former from the latter. [NAIADES, vol. xvi., p. 63.]

Trigonia.

Generic Character.—Animal having the mantle open along its length; no posterior tubes; foot powerful and trenchant.

Shell thick, nacreous, subtrigonal, equivalve, inequilateral, the umbones rather small and but little recurved; hinge complex, dissimilar, the right valve having two great oblong teeth, diverging from the umbo, strongly furrowed, penetrating into two excavations, of the same form and equally furrowed, in the left; ligament external; muscular impressions not united by a pallial impression. (Rang.)

M. Deshayes remarks, that although the discovery of a living species of *Trigonia* by Péron had rendered the determination of the relative position of the genus easier, doubts, which could only be cleared up by the inspection of the animal, still remained. M. Quoy, he observes, who had the good fortune to find the animal, has figured it in the Zoological Atlas of the Astrolabe (pl. 78), and has thus enabled zoologists to form a correct judgment with respect to this curious and important genus.

The animal has the general form of the shell: the lobes of its mantle are disunited for about three-fourths of their circumference. The mantle, which is thickened at the edges, presents undulations equal in number to those of the ribs of the shell: its border is very finely ciliated. The visceral mass is not considerable. At its anterior portion is fixed a foot of very singular construction: it is very much elongated, very narrow, and curved into an elbow-like form in the middle, like that of the *Cardia*; but it differs essentially from the foot of those conchifers, inasmuch as its first part, that which attaches itself to the abdominal mass, is hollowed below into a large triangular gutter in which the second part of the foot can be received. This second part is not rounded: it is triangular, and its lower border, as in the *Pectunculi* and *Nuculæ*, can dilate itself into a disk, on which it is to be presumed that the animal can creep. M. Deshayes proceeds to remark that the structure of the foot in the *Trigoniæ* leads to the supposition that they enjoy two sorts of locomotion, one by leaping, like the *Cardia*, and the other by creeping or ploughing a furrow in the sand. The aperture of the mouth is small, furnished with a rather projecting lip, terminated on each side by small labial palps much shorter than those in the *Nuculæ* and *Pectunculi:* there is a pair of branchial leaflets on each side of the body; but M. Deshayes acknowledges that he knows not whether they are formed of disunited filaments, as in the *Nuculæ*, the *Arcæ*, and the *Pectunculi:* he observes, however, that although the details of the internal organization of the animal are not made out, enough is ascertained for determining with sufficient accuracy the place of the genus in the system. It is, he adds, evidently near the *Nuculæ;* and the only question is, whether it should form a part of the family of the *Arcadæ*, or stand by itself as a small but independent family next to it.

M. de Blainville divides *Trigonia* into the following sections:—

A. Trigonal species.

Example, *Trigonia nodulosa*, fossil, Courtagnon.

B. Suborbicular or Radiated species.

Example, *Trigonia pectinata*, Lam., recent.

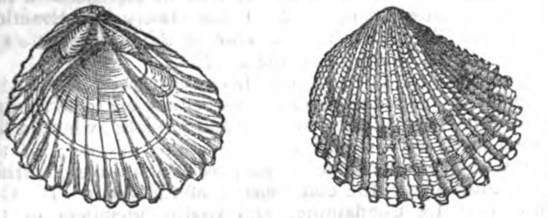
C. Species with a subspiral summit, and a large striated tooth at the hinge. (Genus *Opis*, Defrance.)

Example, *Trigonia cardissoïdes*, fossil.

Only one recent species is known, first published in the *Annales du Museum* under the name of *Trigonia margaritacea*, but Lamarck has recorded it under that of *Trigonia pectinata*.

Description of *Trigonia margaritacea*.—Shell suborbiculate, nacreous within, ribbed externally with elevated verrucose somewhat sharp ribs, disposed in rays; margin plicated.

This species, which has only been found in the seas of New Holland, appears to be of moderate size. Lamarck compares its external appearance to that of a pecten without ears. It has been found at depths ranging from six to fourteen fathoms, on sandy mud.



Trigonia margaritacea.

FOSSIL TRIGONIDÆ.

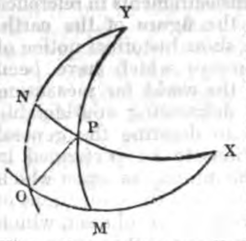
The number of species noted in the tables of M. Deshayes is one recent only; not a single fossil species (tertiary) being there recorded.

Mr. G. B. Sowerby remarks that by far the greater number of the species of this genus are either ribbed on the outside, or covered with tubercles placed in regular or interrupted series; and that a few are only slightly grooved in their young state, or at the rounded side. He observes that the fossil species are numerous, and that they occur in the lias, the upper and lower oolites, and throughout the oolite series of Phillips and Conybeare. Several species, he adds, occur in the beds of green-sand. Dr. Fitton records twenty-two or more species and varieties (*Strata below the Chalk: Table*), principally from the lower green-sand. Mr. Sowerby further remarks, that those found in the Tisbury beds of Portland rock frequently have the ligament remaining. 'We should,' says that conchologist, 'have been much disposed to doubt the probability of any species occurring in strata above the green-sand, if Miss Salisbury had not shown us one which she dug out with her own hands at Muddiford: notwithstanding this fact, the *Trigonia* may be said to characterize the beds below the chalk and above the lias.'

M. Deshayes is of opinion that *Trigonia cardissoïdes*, Lam., does not belong to *Trigonia*, as Lamarck believed, nor to the *Carditæ*, as Mr. Sowerby thought; and as it has not the exact character of any one genus, he retains the generic distinction established for the form by Defrance, under the name of *Opis*.

TRIGONOCEPHALUS. [VIPERIDÆ.]

TRIGONOMETRICAL COORDINATES. These coordinates have lately been invented, independently of each other, by Professor Gudermann, of Cleves, and the Rev. Charles Graves, of Trinity College, Dublin. The latter calls them *spherical coordinates*, a term which is liable to be confounded with the common astronomical coordinates described in SPHERE. This remarkable extension leads to a system of algebraic geometry for curves on a sphere, singularly resembling in its results the common system in a plane, many of the formulæ of the two being absolutely identical. We venture to predict that many difficulties of common algebra, arising from the entrance of the consideration of infinity, will find easy and natural explanations when the common system is considered to be, as it really is, an extreme particular case of this more general view.



Through any point O on a sphere, let arcs OX and OY be drawn, which represent the axes of x and y. Let OX and OY be each of them quadrants, and through any point P let arcs YM, XN be drawn. Then the trigonometrical coordinates of the point P are the tangents of OM and ON, or of the angles subtended by them at the centre. These tangents are called x and y. If the whole system be projected, by lines drawn from the centre of the sphere, upon the tangent plane at O, then OM and ON will be projected into rectilinear coordinates to the projection of P. The equation of a great circle is of the first degree, or of the form $ax+by+c=0$, and an equation of the nth degree belongs to the intersection of the sphere with a cone of the nth degree whose vertex is at the centre. In the polar coordinates OP is the radius of the point, and the angle POM its angle. This system of polar coordinates had been previously considered by Mr. T. S. Davies (*Trans. R. S. Edinb.*, vol. xii.), at great length, and with valuable results. Mr. Graves published his account of the trigonometrical coordinates in the appendix to his 'Two Geometrical Memoirs on the General Properties of Cones of the Second Degree,' &c., Dublin, 1841.

The complete algebra [NEGATIVE, &c. QUANTITIES] may be easily applied to this system. If, in fact, the *tangent* of OP were called the radius vector, instead of OP, and denoted by r, the angle POM being θ, we should have, for rectangular coordinates, exactly as in the plane system,

$$x=r\cos\theta,\ y=r\sin\theta,\quad x+y\sqrt{-1}=r\,\varepsilon^{\theta\sqrt{-1}}$$

TRIGONOMETRICAL CURVES, a name given to curves having such equations as $y=\sin x$, $y=\cos x$, $y=a\cos x+b\cos 2x$, &c. To construct the forms of such curves from the knowledge of the fundamental properties of the sine, cosine, &c., should be an early exercise of the student in trigonometry, and will be of use in his subsequent reading.

TRIGONOMETRICAL SERIES. Infinite series which are of the form $a\sin x+b\sin 2x+c\sin 3x+$ &c., and $a\cos x+b\cos 2x+c\cos 3x+$ &c., are of important use in the higher parts of mathematics. The common mode of finding their equivalents, when $a+bz+cz^3+$, &c., admits of representation in a finite form, is very easy. For instance, let it be required to find $1+a\cos x+a^2\cos 2x+$, &c. Assume $2\cos x=z+z^{-1}$, then $2\cos nx=z^n+z^{-n}$, and substitution gives for the whole series,

$$\frac{1}{2(1-az)}+\frac{1}{2(1-az^{-1})}\text{ or }\frac{2-a(z+z^{-1})}{2(1-a(z+z^{-1})+a^2)}$$

$$\text{which is }\frac{1-a\cos x}{1-2a\cos x+a^2}$$

The most remarkable property of these series is that they are capable of representing discontinuous lines, so that an arc composed of arcs of different curves might have every one of its points made to satisfy an equation of either of the preceding forms. The whole of the discontinuous undulation, for instance, drawn in ACOUSTICS (p. 92) might be included under one equation. See the 'Differential Calculus' (*Lib. U. K.*), p. 621. In the higher parts of physics, this property is of the greatest importance; and without doubt it is one of the most remarkable in the whole range of analysis. But it will not perhaps appear so singular if we remember that every curve made of arcs of different curves can have a continuous curve, represented even by a common algebraical equation, drawn as near as we please to any collection of its arcs. Lagrange showed the use of a finite trigonometrical series to be a very easy mode of actually representing the ordinate of this approximate curve: the infinite trigonometrical series is the limit which actually attains, algebraically speaking, the perfect representation of that to which a finite number of terms is only an approximation.

TRIGONOMETRICAL SURVEY. The method of conducting ordinary surveys for topographical purposes having been explained under another head [SURVEYING], we shall here treat of geodetical measurements in reference only to general geography and the figure of the earth. We propose therefore to give a short historical notice of the principal trigonometrical surveys which have been undertaken in different parts of the world for measuring terrestrial degrees, or accurately delineating considerable portions of the earth's surface; to describe the general nature and objects of the operations to be performed in carrying on such surveys, and the principles upon which the computations are made; and to state the dimensions of the earth, considered as a spheroid of revolution, which have been deduced from the comparison of those measures of meridional arcs which appear to have been executed with the greatest precision.

The merit of first applying trigonometry to geodetic operations belongs to Willebrord Snell [SNELL], who in 1617 undertook a survey of Holland, for the double purpose of establishing the geographical positions of the principal cities in that country, and measuring a degree of the terrestrial meridian. The method which he followed was the same in principle as that which would be adopted at the present time. Having formed a series of triangles extending over the country, he observed their angles with a quadrant, and computed their sides from a base which was carefully measured with wooden perches on the ground. He also determined the direction of the meridian at Leyden, and observed its inclination to a side of one of his triangles, and thereby obtained the bearings of the different angular points. Lastly, by observing the altitude of the pole-star with a five-feet quadrant at Alkmaar, Leyden, and Bergen-op-zoom, he determined the amplitudes of two celestial arcs; and on comparing the amplitudes with the terrestrial distances computed from the triangles, and reduced to the direction of the meridian, he concluded the length of a degree to be 28,500 Rheinland perches, or 55,100 French toises, equivalent to about 66¾ English miles. The result is about 3 miles too small. In 1621 Snell measured a new base, and was preparing to correct some errors which he had detected in the calculations, when his labours were cut short by his early death. Musschenbroek, a century afterwards, re-observed the latitudes, and revised the calculations, and found 1°=57,003 toises, or 69 miles. (Snellius, *Eratosthenes Batavus de Terræ ambitus vera quantitate*, &c., Lugduni Bat., 1617; Musschenbroek, *Dissertationes Physicæ*, &c., Ib., 1729.)

About the middle of the same century Riccioli and Grimaldi undertook to measure an arc of a great circle of the earth in Lombardy. They formed a chain of triangles between Bologna and Modena, observed their angles with a quadrant, and computed their sides from a base measured on the road leading out of Bologna. The distance between the two cities was found to be 20,439 paces. Instead of reducing this distance to the meridian, according to the method of Snell, Riccioli sought to determine the arc of the vertical circle in the heavens intercepted between the zeniths of the two stations. This determination, which presumes an accurate knowledge of the latitudes and the declinations of the stars, could not, in the state of astronomy at that time, be made with sufficient precision, and accordingly the result was still more erroneous than that of Snell. He found the amplitude of the celestial arc to be 19′ 25″, whence 1° = 63,159 paces of Bologna, or nearly 74¼ English miles. (Riccioli, *Geographiæ et Hydrographiæ Reformatæ Libri XII.*, &c., Bononiæ, 1661.)

Picard, in 1669, undertook to measure the meridional arc between Paris and Amiens. This operation was conducted with far greater precision than any previous one of the same kind, and the result had a memorable application, as it furnished Newton with a sufficiently accurate knowledge of the earth's diameter, and consequently of the dimensions of the lunar orbit, to enable him to compute the force of terrestrial attraction at the distance of the moon, and thereby establish the law of gravitation. The angles were measured with a quadrant, furnished with telescopes having cross-wires in their foci (an improvement in the art of observing then newly introduced), and the sides computed from a base of 5663 toises. The latitudes were observed with a zenith sector at Malvoisine (near Paris), at Amiens, and at an intermediate point, so that two comparisons of celestial and terrestrial arcs were obtained, the mean of which gave 1° = 57,060 toises, equivalent to 364,876 English feet, or about 69·1 miles. This is a very near approximation to the true length of the degree at the same place, as it is given by recent and more exact determinations, but it proceeded, in part, from an accidental compensation of errors. (Picard, *Mesure de la Terre*, folio, 1671; *Dégré du Méridien entre Paris et Amiens, par M. Picard, avec les Observations de MM. de Maupertuis, Clairaut, Camus, Le Monnier*, 8vo., 1740.)

Picard's measurement gave rise to a more extensive operation,—the prolongation of the meridian through the whole extent of the French territory, and the construction of a geometrical map of France. The triangulation for this purpose was begun in 1683 by Dominic Cassini, but after a few angles had been measured, the work was suspended till 1700, when it was resumed, and in the following year the triangles were extended to the Pyrenees. The northern part, from Paris to Dunkirk, was completed by James Cassini, in 1718. Cassini adopted Picard's base, but two bases of verification were measured near the extremities of the arc. A very unexpected result was deduced from this operation. On comparing the celestial arc with the measured distance between the parallels of Paris and Collioure (the southern extremity), the length of the degree was found to be 57,097 toises, while the arc between Paris and Dunkirk gave 1° = 56,960 toises. From this it appeared that the degrees of the meridian become shorter as the latitude increases—a consequence directly opposed to the theory of attraction. (Cassini, *Traité de la Grandeur et de la Figure de la Terre*, Paris, 1720; Amsterdam, 1723.)

The discussions to which this result gave rise in the Academy of Sciences were the immediate cause of the two celebrated expeditions to Peru and Lapland, which a few years later were undertaken under the auspices of the French government, for the purpose of definitively settling the question of the compression of the earth. In 1735 Bouguer, La Condamine, and Godin, members of the Academy, set sail for Peru, where they were joined by two Spanish officers, Juan and Ulloa. From the unfavourable nature of the country, the defective state of their instruments, and other causes, this party encountered very great difficulties, and several years elapsed before they were enabled to complete their object. An arc was at length measured on the plain of Quito, between the parallels of 2′ 31″ N. and 3° 4′ 32″ S. lat. A primary base of 6274 toises was measured by Bouguer and Godin separately, and a base of verification at the southern extremity of 5259 toises was found to differ less than a toise from the length computed from the first base through the series of triangles. The measuring-rods were of deal, 20 feet in length, and compared daily with an iron toise, which from this application has been called the toise of Peru, and become celebrated in the history of geodesy, being in fact the standard to which all the degrees measured on the Continent have been ultimately referred, and in terms of which the greater number of them have been expressed. The angles were measured with quadrants of 2½ feet radius, and reduced to the horizon by calculation; in some instances the difference of altitude of two signals observed from the same station exceeded a mile. The latitudes at the extremities were observed simultaneously with zenith sectors. Three different results were computed. Bouguer found the length of the degree, reduced to the sea-level, to be 56,753 toises at the temperature of 13° of Réaumur's scale (61¼° Fahrenheit); Condamine found 56,749 toises, and the Spanish officers 56,768 toises. (Bouguer, *La Figure de la Terre, &c.*, 1749; Condamine, *Mesure des Trois Premiers Dégrés du Méridien dans l'Hemisphère Australe*, 1751; Juan and Ulloa, *Voyage Historique de l'Amérique méridionale*, 1752.)

While Bouguer and his associates were carrying on their operations in Peru, an arc of the meridian was measured near the polar circle by Maupertuis, Clairaut, Camus, Lenonnier, and Outhier. This party reached Tornea, at the extremity of the Gulf of Bothnia, in 1736, and established a chain of triangles along the line of the river stretching northward to the parallel of 66° 48′ 22″ N. lat. A base was measured on the frozen surface of the river. The latitudes were observed with a zenith sector by Graham. The amplitude was found to be 57′ 29″·6, and the terrestrial distance between the parallels 55,023 toises; whence ° = 57,422 toises, exceeding Picard's degree by 362 toises. This result (which however is now supposed to err considerably in excess) put an end to all doubts respecting the decrease of the meridional degrees on going from the equator, and the consequent compression of the earth at the poles. (Maupertuis, *La Figure de la Terre déterminée par les Observations au Cercle Polaire*, 1738.)

Soon after the return of Maupertuis and his party from the polar circle, an important survey was undertaken in France by Cassini de Thury and Lacaille, for the purpose of verifying the former measure of the meridian and laying the foundation of an accurate map of the kingdom. Six new bases were measured, each twice; that near Paris five times. The angles were observed with a two-feet quadrant, and were reduced to the horizon and centre of the station. The latitudes were observed at the extremities and three intermediate stations; and the length of the degree deduced from each of the four arcs. The results are not now important, as the same arc has since been measured with still greater precision by Mechain and Delambre. In the course of the operation the length of a degree of longitude was also determined. The terrestrial arc extended across the mouth of the Rhône from Cette in Languedoc to Mont St. Victoire in Provence; and the difference of longitude was found by exploding gunpowder in the open air at an intermediate station, and noting the difference of the apparent times at which the flash was seen at both extremities. (*La Méridienne de l'Observatoire Royal de Paris Vérifiée*, &c., 1744.)

In 1751 Boscovich and Le Maire began a survey of the Papal States, and in the course of the operation determined the meridional distance between the parallels of Rome and Rimini. The sides of the triangles were computed from a base measured on the seashore near the latter place, which consisted of two parts making an angle of 170° 52′ 15″. Another base was measured on the Via Appia, near Rome. The angles were observed with a quadrant of 3 feet, and the latitudes with a sector of 9 feet. The result gave 1° = 56,979 toises; but it has been shown to be affected with errors of considerable magnitude. (Boscovich, *De Litteraria Expeditione per Pontificam Ditionem ad dimentiendos duos Meridiani Gradus*, &c., Romæ, 1755; De Zach, *Correspondance Astronomique*, vol. vi.)

Lacaille, in 1752, measured an arc of meridian at the Cape of Good Hope. The two extremities were connected by two large triangles, whose common side was deduced by means of two small triangles from a base of 6467·25 toises (7·8 miles), situated near the middle of the arc. The amplitude (1° 13′ 17″·33) was determined with a zenith sector of six feet, and the angles were measured with a 3-feet quadrant. The final result gave 1° = 57,037 toises, or 364,728 English feet, which is nearly equal to the degrees measured in France, 10° farther from the equator. (Lacaille, *Mémoires de l'Acad. Royale des Sciences* for 1751; *Fundamenta Astronomiæ*, 1759.)

On account of the anomalous result of this measure, indicating a dissimilarity of figure in the northern and southern hemispheres, doubts have frequently been entertained of its accuracy; but as Mr. Maclear is at present engaged in the verification and extension of the arc, the question is now on the eve of being set at rest. The correctness of the astronomical amplitude has in fact already been most satisfactorily established; forty stars were observed by Mr. Maclear with Bradley's zenith sector at both extremities, and the difference between the resulting amplitude and that found by Lacaille was less than 0″.21. (*Monthly Notices of the Royal Astron. Society*, April, 1840.)

Beccaria, between 1762 and 1764, measured an arc of the meridian in Lombardy. The instruments and methods used were similar to those of Boscovich. The amplitude was 1° 7′ 47″·7, and the length of the degree found equal to 57,468 toises. This result greatly exceeds that which other measurers gave reason to expect; and the cause has been ascribed to the disturbance of the plumb-line of the sector by the attraction of the mountain masses on which the arc abutted at both extremities. (Beccaria, *Gradus Taurinensis*, &c., 1774.) This arc was re-measured by Plana and Carlini in 1822, who found the amplitude to be 1° 7′ 31″·07, and the degree equal to 57,625 toises, a result still more at variance with other determinations.

Two surveys, executed by Liesganig in Austria and Hungary, between 1762 and 1769, have been usually cited in the history of geodetic measures, but are now known to be deserving of no credit. The Austrian operation comprehended nearly three degrees of the meridian of Vienna, from Brunn in Moravia, to Varasdin in Croatia; and since the beginning of the present century the triangles have been remeasured in the course of a general trigonometrical survey of the Austrian states. For some distance from Brunn, Liesganig's results agree with the recent ones; but in the last triangles (in consequence, it is supposed, of mistaking a signal) the errors in the length of the sides are from 1066 to 2509 toises; while that in the length of the meridional arc amounts to 4533 toises. Baron Zach, who examined the manuscripts of Liesganig, affirms that both the astronomical and geodetical observations were not only faulty and ill calculated, but designedly altered to produce a better agreement. (Liesganig, *Dimensio graduum Meridiani Viennensis et Hungarici*, Viennæ, 1770; De Zach, *Correspondance Astronomique*, vol. vii.)

The first geodetic survey executed in England was undertaken with the immediate object of establishing a trigonometrical connection between the observatories of Paris and Greenwich, in order to determine the difference of longitude. A memoir on the subject, drawn up by Cassini de Thury, was in 1783 presented by the French ambassador to the king, who placed funds at the disposal of the Royal Society for providing the requisite apparatus. In order to accomplish the proposed object, it was necessary to connect the observatory of Greenwich with the French arc of meridian, by carrying a series of triangles from Greenwich to Dunkirk. This was undertaken by General Roy, who began his operations by measuring a base of 27,404 feet on Hounslow Heath in the summer of 1784. For the measurement of the angles a large and exquisitely divided theodolite, having a horizontal circle of three feet in diameter, and carrying telescopes of 36 inches focal length—an instrument far superior to any that had ever been employed in geodetical observations—was constructed by Ramsden. In the summer of 1787, the triangulation was begun by General Roy, assisted by Mr. Dalby, and before the end of the year it was carried to the eastern coast of Kent, and connected with a series of triangles on the opposite coast, which had been extended from Dunkirk to Calais and Boulogne, by Cassini, Mechain, and Legendre. Throughout the whole of this survey the practical operations were conducted with a degree of accuracy and precision, of which, till that time, there had been no example. The methods of calculations were however less excellent; the sum of the three observed angles of each triangle was made equal to 180° by an arbitrary correction, and the sides computed by plane trigonometry. By reason of the small extent of country surveyed, the neglect of the earth's curvature did not lead to any serious error, but such a method of proceeding would be inadmissible at the present day. A base of verification of 28,535 feet was measured on Romney Marsh with a steel chain, and the difference between the measured length and the length computed from the Hounslow Heath base through the series of triangles was found to be only about 28 inches. So near an agreement might afford a satisfactory proof of the general accuracy of the work, but this has since been submitted to a more decisive test. In 1821 and some of the following years, the angles were remeasured by Colonel Colby and Captain Kater with the same excellent instrument, and the triangles calculated with reference to the sphericity of the earth. On comparing the results with those of General Roy, the greatest difference was found to be in the distance between the signals at Dover and Calais, and this amounted only to 12½ feet, the whole distance being 137,472 feet. (Roy, *Phil. Trans.* 1790; *Trigonometrical Survey of England and Wales*, vol. 1; Kater, *Phil. Trans.*, 1828.)

The resolution adopted by the French Convention in 1791 to establish a decimal system of weights and measures of which the unit should be an aliquot part of the quadrant of the meridian, gave rise to a remeasurement of the meridian of Paris from Dunkirk to Barcelona. In the conduct of this survey, the most important in reference to the figure of the earth that has yet been executed, the French astronomers introduced numerous important improvements both into the theory and practice of geodesy. The northern part, from Dunkirk to Rhodez, including about two-thirds of the whole, was assigned to Delambre, and the southern, from Rhodez to Barcelona, to Mechain. Two bases were measured near the extremities; one at Melun, the other near Perpignan, by a method which will be described farther on. All the angles, geodetical and astronomical, were measured with repeating circles, and the observations were examined and compared by special commissioners, who fixed the mean values to be used, and directed the calculations. The azimuths and latitudes were determined at five stations, Dunkirk, Paris, Evaux, Carcassonne, and Montjouy, so that the whole was divided into four partial arcs, the lengths and amplitudes of which are given in the table at the end of this article. No doubt can be entertained of the excellence of the geodetical part of this celebrated operation, but the latitudes have been considered liable to some uncertainty, owing to the feeble power of the telescope and other causes depending on the nature of the instruments with which the observations were made. [REPEATING CIRCLE.] In fact, when Mechain had occasion to determine the latitude at Barcelona, which is only about a mile distant from Montjouy, he found a discordance between the results at these two places amounting to 3″, and all his efforts to reconcile or explain the inconsistency were fruitless.

From the results of this operation, compared with the degree measured in Peru, the dimensions and ellipticity of the earth were deduced, and the *mètre* determined. The earth was assumed to be a spheroid of revolution; the deduced ellipticity was $1 \div 334$; and the *mètre*, or ten-millionth part of the quadrant of the meridian, at the temperature of freezing water, was fixed at 443,296 lines of the toise of Peru, the normal temperature of the iron toise being 13° of Réaumur, or 61° 15′ of Fahrenheit. (*Base du Système Métrique Décimale*, 3 vols. 4to., Paris, 1805, 1807, 1810.)

The prolongation of the meridian through Spain, which formed a part of the original project, was interrupted by the death of Mechain, but was subsequently effected (1807-1809) by Biot and Arago. By means of a very large triangle, one side of which exceeded 100 miles, they connected the island of Iviza with the coast of Valentia; and another triangle carried the arc to Formentera, a small island still farther to the south. The amplitude was thus increased to upwards of 12¼ degrees. (Biot and Arago, *Recueil d'Observations Géodesiques, &c.*, 1821.)

It is a circumstance deserving of notice, that notwithstanding the parade of a commission and the extraordinary precautions taken to ensure accuracy in the computations, a serious error was committed with respect to this arc, which was only recently detected by Puissant. It appears that, through inadvertence or the misapprehension of a formula, the distance between the parallels of Montjouy and Mola (the station on Formentera) was computed without applying the proper correction for the convergence of meridians. The distance originally given by the commissioners was 153605·77 toises; but the distance when the computation is correctly made is 153673·61 toises (Bessel, *Astronomische Nachrichten*, No. 438), the difference being 67·84 toises. In consequence of this correction, and of the introduction of some other arcs since measured into the data for determining the figure of the earth, the length of the quadrant of the meridian expressed in terms of the legal *mètre*, according to the best determination which can at present be made of the dimensions of the earth, is 10,000,855·76 *mètres;* in other words, the legal *mètre* would require to be lengthened by about the ·00,000,856th part of itself in order to agree with the ideal *mètre*, a ten-millionth part of the quadrant of the elliptic meridian. This circumstance may serve to show the futility of any proposal to restore a lost standard from its assigned relation to the magnitude of the earth. The French *mètre* is in fact nothing more than an arbitrary part of the toise of Peru, in terms of which the bases were measured and the meridian computed.

The arc which was measured by Maupertuis and his associates in Lapland in 1736, was remeasured by Svanberg in 1801-1803, and extended in both directions so as to increase the amplitude about 40″. A new base was measured with iron bars which were compared with a standard *mètre* in Paris. The terrestrial angles, as well as the latitudes and azimuths, were measured with repeating circles, and the methods of observing and computing the results the same generally as those of Delambre. All the details of the operation appear to have been executed with great skill and ability: but by reason of the inadequateness of the instrument, the latitudes are not supposed to be very certainly determined; and there is some doubt with respect to the temperature at which the measuring-rods were compared with the standard *mètre*. The result gave 1° = 57,196 toises, which agrees much better than that of Maupertuis with other determinations. (Svanberg. *Exposition des Opérations faites en Lapponie pour la Détermination d'un Arc du Méridien, &c.*, Stockholm, 18[illegible].)

A trigonometrical survey of Holland was executed under the direction of General Krayenhoff, from 1801 to 18[illegible], which may be regarded as a continuation of the general survey of France. No base was measured, but the distances were computed from a side of one of Delambre's adjacent triangles. The angles were measured with repeating circles, and Delambre's methods adopted throughout. As a verification, some distances were deduced from two different series of triangles, and the greatest discordances were found to amount only to one *mètre* in 91[illegible]. (*Précis Historique des Opérations Géodésiques et Astronomiques faites en Hollande pour servir de base à la Topographie de cet état; Exécutées par le Lieutenant-Général Krayenhoff, &c.*, A la Haye, 1815.)

A general survey of the British Islands, under the direction of the master-general of the Ordnance, was begun in 1791, and has been continued to the present time. The first conductors of this national undertaking were Colonel Williams and Captain (afterwards General) Mudge, of the Royal Engineers, and Mr. Dalby, who had previously assisted General Roy. They began their operations by remeasuring General Roy's base on Hounslow Heath with two steel chains of 100 feet in length, which had been very carefully prepared by Ramsden. The result was stated to differ from General Roy's only by 2¼ inches; but it has been remarked (*Ency. Brit.*, Art. 'Trigonometrical Survey') that the two results were given in terms of different scales, and that, when reduced to the same standard, the real difference was one foot, at least if reliance is placed on the comparison of the standards by Captain Kater. For the measure of the angles a new theodolite by Ramsden, of three feet in diameter (originally intended for the East India Company), was purchased by the Board of Ordnance. No general plan of operation appears to have been followed with respect to the triangulation, which was first carried along the southern coast westward for the purpose of determining the geographical positions of the principal headlands and harbours, and has gradually been extended over the whole kingdom. Four other bases, besides the one on Hounslow Heath, were measured in England, namely on Salisbury Plain; King's Sedgmoor, in Somersetshire; Misterton Carr, in Lincolnshire; and Rhuddlan Marsh near St. Asaph. For the determination of the geographical positions the direction of the meridian was determined at five intermediate places between Dover and Land's End, viz. Beachy Head, in Sussex; Dunnose, in the Isle of Wight; Black Down, in Dorsetshire; and St. Agnes Beacon, in Cornwall. In 1801 and 1802 the arc of the meridian extending from Dunnose to Clifton in Yorkshire was determined by Mudge. The two places were connected by a chain of twenty-two triangles, by which the terrestrial distance was computed from the bases on Hounslow Heath and Misterton Carr; and their astronomical latitudes were determined by a zenith sector by Ramsden, carrying an eight-feet telescope. The latitude was likewise observed at Arbury Hill, near the middle of the arc. By means of this intermediate observation and the intersections of the arc by the parallels of the Greenwich Observatory and the duke of Marlborough's Observatory at Blenheim, the whole was divided into four partial arcs, the lengths and amplitudes of which will be given in the table at the end of this article. In 1806 the meridian was extended to a station on Burleigh Moor, in Yorkshire, rather more than a degree to the north of Clifton. With the view of fixing a scale of longitudes for the great map of England, an arc of a parallel circle was determined by means of reciprocal observations of azimuth at Dunnose and Beachy Head, and the geodetical distance concluded from the triangulation. The result gave the length of a degree of longitude on the parallel of Dunnose, viz. 50° 37′ 7″, equal to 232,914 feet, which is longer by about 748 feet than the degree on the spheroid deduced from the best determined arcs of meridian. But this method of determining the difference of longitude is liable to some uncertainty, as the result is considerably effected by small errors in the determination of the azimuths. It is now known that all the longitudes on the southern coast given in the survey are erroneous to the extent of several seconds. (*Phil. Trans.*, from 1795 to 1803; *Trigonometrical Survey of England and Wales*, 1799—1811.)

The last-cited work brings down the history of the survey to 1811, and from that time to the present no authorised or authentic account of the subsequent operations has been published. Were it not indeed for the admirable maps which are from time to time issued from the Ordnance map-office, it might be inferred that the survey had been discontinued during the last thirty years. The operation has however never been lost sight of, and is at present in active progress. For some years after the last published account, the triangulation was carried on in Scotland both along the eastern and western coasts. About 1818 the survey of Ireland was begun. A base was measured on the banks of Lough Foyle, near Londonderry, with an apparatus (which will be described farther on) differing from any which had previously been used, and with precautions to ensure accuracy which probably have never been surpassed. Depending on this base, a network of triangles was established over the whole of Ireland, and the angles measured partly with the great theodolite of Ramsden, and partly with a new instrument of the same kind, of two feet in diameter, constructed by Troughton and Simms. By means of some large triangles stretching across the channel, the Irish triangles were connected at several points with those formerly observed in Wales and the west of Scotland; so that these last, which were computed from bases measured with the steel chain, may be, and no doubt have been, also determined in terms of the new base. It may be presumed that the sides of the triangles—not only in Ireland, but in Scotland also—will be computed from the Irish base, about the accuracy of which there can be no question. With the exception of one or two counties, the topography of Ireland has been completed; and we are informed that the angles of the different chains of primary triangles extending over the whole of Scotland and the adjacent islands have now also been observed. Astronomers look forward with much interest to the completion and publication of the details of this great national undertaking, the experience and well-known ability of the distinguished officer to whom the direction of the survey has so long been confided giving assurance that it will be in every respect worthy of the age and the country.*

A trigonometrical survey of India was begun by Colonel Lambton in 1791, which has been continued, since his death in 1823, under the direction of Colonel Everest. It was originally undertaken for the purpose of connecting the coasts of Coromandel and Malabar, and of determining the latitudes and longitudes of the principal places in the peninsula; and although it has of course been carried on chiefly for the purposes of general geography, it has afforded an important contribution to our knowledge of the earth's figure by two arcs of meridian, one of them the longest which has been measured in any country. The first was in the neighbourhood of Madras, and its amplitude only 1° 35′. The second begins at Punnæ, near Cape Comorin, lat. 8° 9′ 32′; was continued up to the middle of the peninsula to Daumergidda, lat. 18° 3′ 16″, by Colonel Lambton; and has been extended to Kullianpoor, lat. 24° 7′ 11·8′ by Colonel Everest. In connection with these arcs six bases were measured by Colonel Lambton, and two by Colonel Everest. The methods of proceeding were in almost all respects the same as in the Ordnance survey of England. The bases were measured with a steel chain of 100 feet. The horizontal angles were observed with a theodolite of three feet diameter by Cary, and the latitudes with a 5-feet zenith sector by Ramsden. It is not easy to form a correct opinion of the degree of confidence to which the results of these operations are entitled. Judging from the statements of Colonel Everest, we are disposed to regard them as considerably inferior, in respect of probable accuracy, to those obtained in the early part of the Ordnance survey, and assuredly not to be put in comparison with those of the recent surveys in Ireland, and in France and Germany. It appears that on one occasion the great theodolite received an accidental blow by which the limb was completely distorted, and though the injury was so successfully repaired by Colonel Lambton that the difference of arcs of 90°, taken on any part of the limb, was found not to exceed 26″, more than usual caution must have been necessary in the subsequent use of the instrument. Prior to the measurement of one of the bases it was found that the joints of the steel chains were thickly covered with rust, in clearing away which the length could scarcely fail to be altered. In the actual measurement the measuring-chain was not supported on coffers, or stretched by a constant weight: it was laid on the ground and stretched by a hand-capstan. These circumstances give reason to presume no high degree of precision. With respect to results, the meridional distance between Daumergidda and Takal K'hera, deduced from the Beder base (measured by Colonel Lambton), was 1,105,618 feet, and the same distance deduced from the Takal K'hera base (measured by Colonel Everest) was 1,105,381 feet, the difference being 237 feet; and when the former base was computed from the latter, through the series of triangles, the differences between the computed result and the actual measure was found to be 78·72 inches. Discordances of such amount are incompatible with the extreme precision now aimed at in geodetical operations, but great allowance must be made for the difficulties arising from the climate, the nature of the country, and other unfavourable circumstances; and indeed it would scarcely be possible to appreciate too highly the ability, energy, and devotion displayed both by Colonel Lambton and Colonel Everest in the conduct of this important survey. It is satisfactory to be able to add that the recent operations appear to have been carried on in a manner which will place the results beyond suspicion. In 1834-35 a new base was measured by Colonel Everest at Dhera Dun, in the Doab territory, with a compensating apparatus similar to that used by Colonel Colby in Ireland. The length was nearly 7½ miles. It was measured twice, and the difference between the two results amounted only to 2·4 inches. (Lambton, *Asiatic Researches*, vols. viii., x., xii., xiii.; *Phil. Trans.*, 1818; Everest, *Account of the Measurement of an Arc of the Meridian between the parallels of* 18° 3′ *and* 24° 7′, &c., 1830; Id., *Monthly Notices of the Roy. Astron. Society*, June, 1839.)

Since the last general peace trigonometrical surveys have been carried on in all the principal countries of Europe—England, France, Italy, Austria, Bavaria, Denmark, Prussia, and Russia. It would be foreign to our purpose to describe the details of these operations, even if the materials for doing so were at our command; but we shall briefly notice those which have a scientific interest, by reason of the data they afford for determining the figure of the earth.

Of the surveys now alluded to, one which was carried across the Alps in 1821 and some of the following years, is remarkable by reason of the difficulties the country presented. The special object was to connect two series of triangles, which had formerly been measured along the mean parallel of 45°, on opposite sides of the Alps; one extending from Fiume in Illyria to Turin, and the other stretching across France from Cordouan (near Bordeaux) to the frontier of Savoy. This operation was undertaken jointly by the Austrian and Sardinian governments, and executed by parties of engineer officers of both countries, who acted independently of each other, so that all the angles were measured twice with different instruments. Combined with the previous surveys, it gave the length of an arc of the mean parallel extending through nearly 13° of longitude. By means of instantaneous fire-signals (explosions of gunpowder) observed at the extreme and five intermediate stations, six independent comparisons of the astronomical and geodetical arcs were obtained, but the results did not present a satisfactory agreement. The whole length was

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* Since this article was in type, a volume of the Ordnance survey has appeared under the title of 'Astronomical Observations made with Ramsden's zenith sector, together with a Catalogue of the Stars which have been observed, and the amplitudes of the celestial arcs deduced from the Observations at the different stations.' The stations are Dunnose, Dunkirk (in France), Greenwich, Arbury Hill, Delamere, Clifton Beacon, Burleigh Moor, Kellie Law in Fifeshire, Cowhythe Hill in Banffshire, and Balta, the easternmost of the Zetland islands. The amplitude of the meridional arc between the parallels of Dunnose and Balta is 10° 7′ 55″.28. Colonel Colby states in the preface, that the terrestrial observations requisite to enable him to complete and publish the geodetical distances connected with the astronomical results are now in so advanced a state that the printing of them will shortly be commenced.

3,316,970 English feet, on the parallel of 45° 43′ 12″; and the amplitude was 12° 59′ 3·8″, whence 1° of longitude on that parallel contains 255,459 feet. The length of the degree of the same parallel, on the spheroid which corresponds to the measured arcs of meridian, is 255,397 feet, the difference being only 62 feet. In connection with this operation the remeasurement of Beccaria's arc, to which we have already alluded, was executed by Plana and Carlini. (*Opérations Géodésiques et Astronomiques pour la Mesure d'un Arc du Parallèle Moyen*, Milan, 1825, 2nd vol., 1827; *Connaissance des Tems*, 1829.)

Two arcs of meridian have been recently measured in Hanover and Denmark, which, though of comparatively small extent, are very valuable by reason of the skilful manner in which the operations were conducted, and the great probable accuracy of the results. The first was obtained by connecting the two observatories of Göttingen and Altona, which are situated nearly in the same meridian, by means of a chain of triangles proceeding from a base which was measured by Gauss in 1820. From the same base another chain of triangles was carried through Denmark, by means of which the geodetical distance between the parallels of Lauenburg (in Hanover) and Lysabbel (in the island of Alsen) was computed. The celestial arc was determined by Schumacher with Bradley's zenith sector, sent from the observatory at Greenwich for the purpose. (Gauss, *Bestimmung des Breitensunterschiedes zwischen den Sternwarten von Göttingen und Altona, &c.*; Bessel, *Astron. Nachrichten*, No. 333.)

An extensive trigonometrical operation has been carried on in Russia for a series of years, and an arc, exceeding 8° in amplitude, been measured on the meridian of Dorpat, 26° 43′ 45″ to the east of Greenwich. We have the details with respect only to the portion of the arc comprehended between Jacobstadt (on the Düna) and Hochland (in the Gulf of Finland), which was measured by Struve between 1821 and 1831. For observing the angles, Reichenbach's *universal instrument*, having a horizontal circle of 14 inches diameter, was used; and the amplitude was determined with a transit-instrument moving in the prime vertical. [LONGITUDE AND LATITUDE.] The arc was nearly bisected by the observatory of Dorpat. (Struve, *Beschreibung der Breitengradmessung in den Ostseeprovinzen Russlands*, &c., Dorpat, 1831.) This arc has since been extended by General von Tenner southwards to Belin, and as the latitude was observed both at that place and at Nemesch (between Belin and Jacobstadt), two independent arcs have in fact been added to the two measured by Struve. (Bessel, *Astronomische Nachrichten*, No. 333.)

The last survey we shall mention is one which was executed by Bessel, in Prussia, between 1831 and 1836. The immediate object of this undertaking was to connect the Russian triangulation with a chain of triangles which had been measured in the western part of Prussia, extending through Hesse, Thuringia, and Brandenburg to Silesia, and connecting the Dutch (and thereby also the French and English) triangles with those of Bavaria and Austria. In this operation Bessel included the measure of an arc of the meridian of Königsberg. A base of 935 toises was measured with great precision. The angles were observed with a theodolite of 15 inches diameter, and the latitudes at the two extremities (Truntz and Memel) determined, as in Struve's method, with a transit-instrument adjusted in the prime vertical. The details are given by Bessel in a work which should be in the hands of every one concerned with geodetical operations of the highest order. (Bessel, *Gradmessung in Ost-Preussen und ihre Verbindung mit Preussischen und Russischen Dreieckskettten*, Berlin, 1838.)

By means of the different surveys to which we have now alluded, the greater part of Europe has been covered with chains of triangles, whereby not only the geographical positions of all the principal places and remarkable objects have been determined by actual measurement, but all the measured arcs of meridians and parallels, and all the principal observatories, have been trigonometrically connected with each other. The comparison of the astronomical and geodetical positions of so many connected points is, perhaps, even better calculated to lead to an accurate knowledge of the local configuration of this quarter of the globe than the measurement of isolated degrees.

We proceed now to give a general view of the methods of conducting a trigonometrical survey and computing the results of the observations.

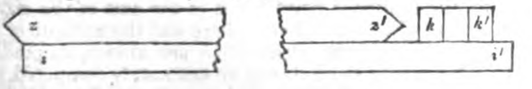
Measurement of the Base.—The foundation of every trigonometrical survey is the measurement of a ground-line or base, in terms of which all the distances are to be computed. This is an operation which is attended with considerable difficulty, and requires to be executed with the most minute precision; for any error with which the result may be affected is multiplied in the sides of the triangles in the ratio of their length to the length of the base; and all other distances concluded from the survey are affected in the same proportion. An error in the base amounting only to an inch in the mile would vitiate the determination of the earth's diameter to the extent of 110 yards.

The general method of proceeding may be thus described:—A piece of ground must be selected as free from obstructions and as nearly level as possible. The terminal points must be defined by permanent marks; for example, by a fine dot, or the intersection of two straight lines, on a plate of metal, securely fixed in the ground. In order to trace the line of the base, a transit-instrument is adjusted over one of the terminal points, and directed to a flag-staff or other signal erected at the other, by which means the observer is enabled to direct an assistant to plant pickets in the ground, all ranging in the same vertical plane. The measuring apparatus may be constructed and applied in various ways, but in all cases the following conditions must be observed:—1, The successive measuring-rods (or chains) must be arranged accurately in the vertical plane passing through the terminal points of the base; 2, the temperature of the rods must be observed at the time they are applied, and their rate of expansion determined by direct experiment, in order that the apparent lengths may be reduced to the length at a given temperature; 3, they must be supported in such a manner as to have no tendency to flexure; and 4, each rod, when adjusted in the line of the base, must be exactly horizontal, or its inclination exactly determined by levels, in order that the corresponding horizontal distance may be computed.

Previously to General Roy's measure of the base on Hounslow Heath, the measuring apparatus used in all similar operations (with the exception of one of the bases measured by Lacaille and Cassini in France) consisted of deal rods, usually about 20 feet in length; but deal rods, however well seasoned, are found to be considerably affected by the hygrometrical state of the air, and liable to sudden and irregular expansions and contractions, the effects of which cannot be accurately estimated, even when they are compared from time to time with a standard metallic bar. For this reason General Roy, after he had measured the base with deal rods, measured it a second time with hollow glass tubes. The tubes were 20 feet in length and about an inch in diameter, and the extremities were defined by metal buttons, ground perfectly flat, and perpendicular to the axis of the tube. At one end this apparatus was fixed to the tube; at the other it was attached to a sort of piston, or slider, capable of being pushed up a certain way within the tube against a slender spring. A fine line marked on the slider, and another on the glass tube, were so adjusted, that when the slider was pushed up until the lines came into coincidence (which was observed through the glass), the distance between the flat ends of the metal buttons was exactly 20 feet at the temperature of 62° Fahrenheit. In making the contacts, the flat end of one rod was pressed by a screw apparatus against the moveable end of the other, until the coincidence of the lines took place, so that a constant pressure was applied equal to the tension of the spring. When the Ordnance survey was begun, this base was again measured with a steel chain, made by Ramsden, of 100 feet in length, and consisting of 40 links, terminated by a brass handle at each end. When in use the chain was supported on wooden coffers, raised on trestles, and stretched with a weight of fifty-six pounds. The extremities were defined by marks on the brass handles; and in order to bring the marks successively to the same point on the base-line the following contrivance was adopted:—a brass scale, firmly secured to a post driven into the ground, but not connected with the chain or its supports, was placed contiguous to the preceding end, A, and adjusted by means of a screw apparatus, so that a division on the scale coincided exactly with the mark on the handle. The chain was then carried forward one length; and when again placed on the coffers, was drawn back against the stretching-weight, until the mark on the handle at the following end, B, coincided with a division of the scale which had remained fixed in its place. In this manner the marks on A and B either occupied the same point on the line of the base, or the distance between them was known in terms of the scale. The same method was followed in measuring several other bases in England in the course of the survey, the chain being compared before and after each operation with another similar chain which was kept for this purpose. The advantage of the chain depends solely on its great length, by reason of which the number of coincidences (in making which the chief difficulty consists) is considerably reduced; but this advantage is probably more than counterbalanced by its liability to alteration from wearing or corroding at the joints, and the insufficient security afforded that, notwithstanding the stretching, all its points are in the same straight line. The use of the chain has been confined to the English and Indian surveys, and is now abandoned in both.

The apparatus used by Delambre and Mechain in measuring the two bases in France, on which the length of the meridian depends, was constructed as follows:—The measuring-rod was a thin bar of platinum, two toises in length, half an inch in breadth, and two lines in thickness. This was covered by another bar of copper, somewhat shorter, the two being firmly connected by screws at one end, but free at every other point, so that the expansions and contractions of each were not affected by the other. The relative expansions were thus indicated by the distance between the free extremities of the two bars; for measuring which a finely divided scale was cut on a part of the platinum bar, and a vernier attached to the extremity of the copper bar. The relative expansion gave the means of computing the absolute expansion of the platinum bar at the time of the measurement. Four of these compound bars were used together; and when all were adjusted in the line of the base, and the requisite observations made and recorded, the last was carried forward and placed first, the others being left in their places. The ends were not brought into contact; a small interval was left between each and the next, which was measured by a slider, or small scale of platinum, attached to that end of the platinum-bar which was not covered by the copper bar. For the measure of the Hanoverian base Gauss employed three bars of hammered iron, two toises in length, and about an inch and a half in breadth and thickness, enclosed in boxes so as to leave only the ends projecting, and supported by counterpoises to prevent flexure. The ends were covered with steel plates, one flat and the other spherical; and when the bars were placed in the line of the base, a small interval was left between the flat end of one bar and the spherical end of the preceding one, which was measured by dropping into it a thin wedge. Struve also employed iron bars in measuring the Russia base. In this case however the ends of the bars were brought into contact, and the contacts made on a principle similar to that which had been adopted by General Roy in using the glass rods. But the apparatus which formed the moveable extremity of Struve's rod consisted of a bent lever which turned on an axis passing through the bar, near its extremity, the motion of the short arm of the lever being in the direction of the length of the bar. The short arm terminated in a hemisphere which projected a little beyond the end of the bar; and in making the contacts, the flat and fixed end of the next bar was pressed against the hemisphere, until an index on the extremity of the long arm of the lever stood at the middle of a scale connected with the bar, in which position the distance between the plane in which the bar terminated at one end, and the apex of the hemisphere at the other end, was exactly two toises at the normal temperature. A steel spring acting on the long arm of the lever regulated the degree of pressure applied in making the contacts.

Fig. 1.



In measuring the Prussia base Bessel used four compound bars constructed on the same principle as those of Delambre. The apparatus, which is simple and ingenious, will be readily understood from the annexed figure, in which the two ends are shown. $i\,i'$ is a bar of iron two toises in length, an inch broad, and a quarter of an inch thick. $z\,z'$ is a bar of zinc of the same thickness and half the breadth. The two bars are firmly connected by screws and soldering at the end $z\,i$. The zinc bar $z\,z'$ terminates in two knife-edges of steel, the edges being horizontal. $k\,k'$ is a part of the iron bar, terminating in knife-edges, which are placed vertically, or at right angles to the former. The length of the measuring bar, or two toises at the normal temperature, is defined by the knife-edges at z and k'; while the interval between z' and k varies with the temperature, and indicates the relative expansion, from which the absolute expansion of the iron bar becomes known. This interval was measured by inserting a thin glass wedge between the knife-edges; and when the bars were placed in the line of the base, the interval between the knife-edge k' of one bar and z of the adjacent one was measured in the same manner. By means of fine divisions on the parallel sides of the glass wedges an interval in the direction of the base so small as the 12,000th part of an inch was made visible.

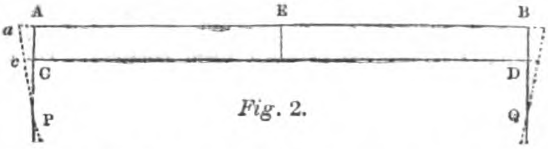


Fig. 2.

For the measurement of the Irish base an apparatus was employed by Colonel Colby in which the expansion of the measuring-rods was compensated in such a manner that no reduction was required on account of variations of temperature. The principle of this very ingenious apparatus will be understood from the following description:—A B is a brass bar, 10 feet in length. C D a bar of iron, firmly connected with the former at the middle E. Two steel tongues A P, B Q are connected with the extremities of the bars by double conical joints which allow sufficient play to the tongues to prevent interference with the free expansions of the bars. At a certain normal temperature the steel tongues are perpendicular to the direction of the bars. Suppose them in this position, and that an increase of temperature takes place: the brass bar will become longer than the iron bar in consequence of its greater relative expansion, and a straight line A C P (on the middle of the tongue) will come into the position $a\,c$ P, intersecting its former direction at a point P, so situated that P C has to P A the ratio of the expansion of the iron bar to that of the brass bar. But this ratio being constant, P is a given point; and as the corresponding point Q on the other tongue is in precisely the same circumstances, it follows that the distance between P and Q will remain unaltered in all temperatures, provided at least both bars have the same temperature. This invariability is however not absolute, for when the tongue comes into the oblique position a P is longer than A P, and consequently the point marked on the tongue will be between a and the invariable point. Hence an increase of temperature must increase the distance between P and Q: but the effect is insensible. The distance between the two bars was about two inches, and the distance of P from the iron bar or P C (which was determined experimentally) about three inches and a half. The bars were enclosed in strong wooden cases, having only the ends of the steel tongues exposed, and the cases laid upon trestles. Five or six sets of bars were used together; and when levelled and adjusted in the line of the base, the interval between the point Q on one set, and the point P on the next, instead of being variable (as in the methods of Delambre and Bessel), was made equal to a given constant quantity. This was effected by means of a microscopic apparatus, constructed on the same principle as the measuring apparatus, two microscopes taking the place of the steel tongues, and their foci being the points whose distance remains invariable. The microscopes were six inches apart, and between them, at the same distance from each, was a small telescope invariably connected with the two metallic bars to which the microscopes were attached; the whole being so disposed that the three optical axes were in the same plane, and parallel to each other at the normal temperature. This apparatus being placed parallel to the line of the base, over the end of one of the sets of measuring bars, in such a manner that the point Q on the steel tongue was bisected by the cross-wires of one of the microscopes, the next set of bars was moved backwards or forwards until the point P was bisected by the cross-wires of the other microscope. A very delicate level fixed on the upper bar of the microscopic apparatus gave the means of adjusting the optical axis of the telescope exactly in the vertical; by which means, when it was necessary to suspend the operations, or to change the level of the line of the base, the point from which the measurement was to be resumed could be determined with much greater precision than by the usual means of a plummet. The measuring-bars were compared (daily, we believe) with a standard iron bar, which therefore is the unit of the distances; and the interval between the foci of the microscopes was in like manner verified by comparison with a scale.

The question of superiority among these different modes of measuring a base must be decided with reference to practical convenience: it cannot be affirmed that the results of any one of them are decidedly more accurate than those of the others. Col. Colby's apparatus is exceedingly beautiful in theory, but the play of the joints by which the tongues are connected with the bars, and the uncertainty there must be about the determination of the invariable points, and that their distance remains unaltered while changes of temperature are taking place, are obvious disadvantages. Bessel's apparatus is the most compact, and in fewest pieces; and we should imagine that his mode of measuring the intervals between the successive bars would be found easier in practice than making the distance between them constant. On the other hand, the adjustment of a point under the focus of a microscope is an operation which can probably be executed with greater precision than the measurement of the distance between two solid bodies, whether by a scale and vernier, according to the method of Delambre, or by a finely-divided wedge, as used by Gauss and Bessel.

The length of the base is a matter of some importance. Theoretically speaking, it cannot be too long. If a distance on the earth's surface (an arc of meridian, for example) deduced from a trigonometrical operation be m times the length of the base, then, putting errors of observation and calculation out of view, the probable error in the distance is to the probable error of the base in the ratio of $\sqrt{m} : 1$; consequently the longer the base the less is the probable error of the result. On the other hand, the probable error in the measurement of the base increases as the square root of its length; so that a distance deduced from a base of three miles measured only once would have as great a probable error as if it had been deduced from a base of only one mile measured three times, and the mean result taken as its true length. General Roy's base on Hounslow Heath was 27,403 feet, or about 5¼ miles; and the other bases measured in England were from 4·6 miles to about 7 miles. In the Indian survey the bases averaged about seven miles. The two bases at Melun and Perpignan, on which the great French arc of meridian depends, were both upwards of seven miles, and each consisted of two parts inclined to each other. In the Irish base eight miles were directly measured with the compensation bars, and two miles were added by triangulation. Struve's base was 2315 toises, or about 2·8 miles. The Prussian base, measured by Bessel, was only 935 toises, or about a mile and an eighth. Baron Zach, who measured some small bases in Italy, contends that long bases, such as were measured in the French, English, and Indian surveys, are attended with no advantages corresponding to the expense they occasion; and Professor Schwerd, in an interesting account of a base of 2[illegible]8 feet, measured by him near Spire, reasons to the same effect. (*Die Kleine Speyerer Basis*, Speyer, 1822.) Although we cannot subscribe to these opinions, it must be admitted that as instruments and the methods of observing and computing the observations have been improved, the necessity for frequent verification by the measure of new bases has been proportionably diminished.

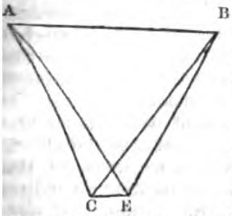
When the measuring-rods have been applied to the whole line of the base, and the proper reductions made for expansion, inclination, &c., the distance is obtained between the terminal points, in terms of the standard to which the measuring-rods are referred, on an arc of a great circle of the earth. In order that the results of different surveys may be comparable with each other, this circle must have a determinate radius; and hence it is usual to substitute for the arc actually measured, the corresponding arc on the surface which coincides with the mean level of the sea. Let l denote the measured length of the base, l' its length reduced to the mean level of the sea, h its height above that level, and r the radius of the earth: the l' is found from this proportion, $r+h : r :: l : l'$.

Triangulation.—In commencing the triangulation, the first step is to make choice of the points or stations which are to form the summits of the principal triangles. The choice of stations must be determined in some measure by the nature of the country, and with reference to the objects of the survey; but care must be taken to avoid very acute angles, because small errors in the measurement of such angles will give rise to large errors in the lengths of the sides deduced from them. The best-conditioned triangles are those which are nearly equilateral. The principal triangles should be of considerable magnitude, for the probable error of a distance deduced from a base through a series of triangles increases with the number of intermediate triangles. Sides averaging from 20 to 50 miles may be considered as the most convenient; but in mountainous countries, or for connecting stations separated by the sea, the magnitude of the triangles will sometimes be limited only by the distance at which the signals cease to be visible from each other. When the object of the survey is the topography of the country, the geographical positions (the latitudes, longitudes, and altitudes above the sea), as well as the mutual distances of these primary stations, should be determined with all the precision it is possible to attain. The more remarkable features of the country are afterwards connected with the principal stations, by *secondary* triangles, which, being liable only to small relative errors, may be determined more expeditiously by less precise observations or with inferior instruments; and the intermediate points are filled in by means of the surveyor's compass and chain. [SURVEYING.]

Signals.—When the stations have been chosen, the next point to be considered is the erection of signals. In the earlier surveys, the usual practice was to select such conspicuous objects as the country presented, as church spires, windmills, &c.; but experience has shown that objects of this kind, even when found (which will seldom be the case) in those positions where it is desirable that the angular points of the triangles should be established, are not well adapted for signals, and that in general the most advantageous course is to construct them for the express purpose. In the earlier part of the English survey, the observations were chiefly made by night, and the signals were reverberatory lamps with concave metallic reflectors supported by flag-staffs, and enclosed in tin cases, having plates of glass in front to screen the light from the action of the wind. Such signals answer well enough for distances under 30 miles. Biot and Arago, in the prolongation of the French arc of meridian, also employed reverberatory lamps and concave reflectors; and in one case the distance between the station and the signal exceeded 100 miles. Bengal lights, blue-lights, and other contrivances have also been used as night-signals. Delambre constructed his signals of wood in the form of truncated four-sided pyramids, and observed by day. For the large triangles in Ireland and the west of Scotland, Colonel Colby built up conical piles of dry stone, which were thrown down when the instrument was taken to the spot, and again built up when it was necessary to observe the same signal from other stations. Such signals were found to be visible in the telescope of the great theodolite at the distance of 90 or 100 miles in favourable weather. Plates of polished metal, placed so as to reflect the light of the sun in the proper direction, have been found a powerful means of rendering a station visible. Gauss proposed the heliotrope, in which the reflecting surface is silvered glass; and this was the signal which was principally used by Struve and Bessel. Another method, adopted by Bessel for short distances, was the reflexion of light from a hemisphere of polished copper. These two last methods have the disadvantage of rendering the observer dependent on sunshine, but in other respects they afford excellent signals, for as the light proceeds from a point, the observation is made with the greatest precision. In the case of the hemisphere, indeed, the luminous point is not in the axis of the signal, but as the radius of the hemisphere and the azimuth of the sun at the time of the observation are known, its position with reference to the axis can be accurately computed, and a correction applied if the deviation is sensible. But all lid bodies used as signals render a similar correction ecessary when the light falls upon them obliquely. To oid this inconvenience, Svanberg observed the light of e sky through a rectangular opening in a blackened ard which turned about a vertical axis, so that its plane uld always be placed perpendicular to the visual ray. ight-signals are found inconvenient by reason of the uneadiness and the scintillations of the light; and accordgly geodetical observations are now generally made by y; nevertheless, under peculiar circumstances, night servations may be advantageous, or even necessary. hus, in India, Colonel Everest found that the greater reaction during the night sometimes rendered stations sible which could not be seen by day, being hid by the tervening ground.

With respect to instruments and the methods of observg in geodetical surveys, ample information is given in e articles THEODOLET, REPEATING CIRCLE, &c. We ay here remark however, that as each signal (speaking enerally) is the common vertex of several triangles, an ngle required for the calculation of a triangle may freuently be obtained from the sum or difference of other ngles at the same point, as well as by direct observation. his circumstance permits the observations to be made various ways, and affords an important means of verifiation; but in order that full advantage may be derived om it, the observations must be made and combined acording to some systematic plan. Struve, in the Russian riangulation, adopted the plan of observing successively he direction of every signal visible from his station, in eference to a certain arbitrary direction; and the same ethod was followed by Bessel. This appears to be the ode of conducting the observations by which an observer s enabled to make the most of his position.

Reduction to the Centre of the Station.—It is desirable hat the centre of the instrument should always be placed n the vertical line which coincides with the axis of the ignal at the same station; but the strict fulfilment of this ondition may sometimes be impossible, or at least xtremely inconvenient. In such cases the instrument is laced *near* the station, and a correction made for the eccentricity. Let C be the centre of the station, E the place where the instrument is placed, A and B the distant signals, so that A C B is the angle which is required, and A E B the angle actually measured. Let the distance C E be denoted by d, and A C (computed approximately) by m; then the difference, in seconds, between A C B and A E B is found from this formula—



$$\text{ACB} - \text{AEB} = \omega\, d \sin(\text{BAC} - \text{BEC}) \div m \sin \text{BAC},$$

where $\omega = 206264{\cdot}8''$, the number of seconds in an arc equal to the radius, or $\omega = \operatorname{cosec} 1'' = 1 \div \sin 1''$.

Reduction to the Horizon.—Although the theodolite has now come into general, perhaps universal, use in carrying on important geodetical operations, we shall add the formula by which an angle measured in the oblique plane passing through the instrument and the two observed objects is reduced to the horizon. Let A and B be the remote signals, C the angle in the oblique plane, C′ its projection on the plane of the horizon; and let α and β denote respectively the number of seconds by which A and B are observed to be elevated or depressed above or below the horizon of C; then

$$C - C' = \{\tfrac{1}{4}(\alpha + \beta)^2 \tan \tfrac{1}{2} C - \tfrac{1}{4}(\alpha - \beta)^2 \cot \tfrac{1}{2} C\} \sin 1''.$$

When the angles have been measured, and (if necessary) deduced to the centre of the station and the horizon, their values as given by the instrument, being all affected with some portion of error which it is impossible by any means to get rid of, must undergo a process of correction or adjustment, or be made to satisfy certain mathematical conditions, before a determinate result can be deduced from them. In order to establish these conditions the following quantity must be computed for every triangle in the series.

Spherical Excess.—The spherical excess of a triangle on the surface of a sphere or spheroid, formed by the sections of planes perpendicular to the surfaces, is the excess of the sum of its three angles over 180°. This excess has a given relation to the area of the triangle depending upon the radius of the sphere; and in a geodetical survey the data for computing it are, in every case, a side c, and the three observed angles A, B, C, of which C is supposed opposite to c. Let S denote the number of square feet in the surface or area of the triangle, E the spherical excess in seconds, and r the radius of curvature in feet; we have then $S = \frac{1}{2} cc \sin A \sin B \div \sin C$, and $E = \omega S \div rr$, where $\omega = 206264''{\cdot}8$.

On the spheroid, the radius of curvature of a section perpendicular to the surface is variable, and depends both on the latitude and the inclination of the section to the meridian. For a series of triangles included between two parallels of latitude whose distance is not more than two or three degrees, r may be supposed constant in computing the spherical excess; and as the nearest approximation to its mean value, we may take the radius of curvature of the section which intersects the meridian in an angle of 45°, at the middle latitude. The general formula for the radius of curvature of an oblique section is

$$\frac{1}{r} = \frac{(1 - ee + ee \cos^2 l \cos^2 \theta)\sqrt{(1 - ee \sin^2 l)}}{a\,(1 - ee)}$$

where a is the radius of the equator, e the eccentricity (so that $ee = (aa - bb) \div aa$, b being half the polar axis), l the latitude, and θ the azimuth, or inclination of the section to the meridian.

Let ρ denote the radius of curvature of the meridian (for which $\theta = 0$), ρ' that of the section perpendicular to the meridian (for which $\theta = 90°$), the formula gives

$$\frac{1}{\rho} = \frac{\sqrt{(1 - ee \sin^2 l)^3}}{a\,(1 - ee)}\,; \quad \frac{1}{\rho'} = \frac{\sqrt{(1 - ee \sin^2 l)}}{a}\,;$$

whence also

$$\frac{1}{r} = \frac{1}{\rho} \cos^2 \theta + \frac{1}{\rho'} \sin^2 \theta = \tfrac{1}{2}\left(\frac{1}{\rho} + \frac{1}{\rho'}\right) + \tfrac{1}{2}\left(\frac{1}{\rho} - \frac{1}{\rho'}\right) \cos 2\theta\,;$$

from which $1 \div r$ is readily computed for any value of θ. When $\theta = 45°$, the second term vanishes.

In the latitude of Greenwich (51° 28′ 39″), $\rho = 20911961$ feet, $\rho' = 20966473$ feet, whence (making $\theta = 45°$) $\log(\omega \div rr) = 0{\cdot}67251 - 10$, and consequently $\log E = \log S + 0{\cdot}67251 - 10$. In order that E may amount to $1''$, we must have $\log S = 9{\cdot}39749$, or $S = 2{,}497{,}800{,}000$ square feet, or nearly $76\frac{1}{4}$ square miles, that is to say, the spherical excess amounts to $1''$ for every $76\frac{1}{4}$ square miles in the area of the triangle. The calculation of the area therefore does not require to be made with much accuracy, and may be facilitated by means of subsidiary tables.

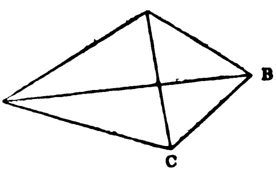
Correction of the Observations.—One of the improvements for which practical geodesy has recently been indebted to the German astronomers, particularly Gauss and Bessel, is a general method of combining and correcting the observations according to the principles of the theory of probability, so as to elicit the result which is *most probably* nearest the truth, or which gives the nearest representation of the whole of the observations. Formerly the practice was to regard each triangle as a complete and independent whole, and to adjust the observed angles (usually by some arbitrary process, or according to the observer's judgment of their relative goodness), so as to fulfil the condition of their sum being equal to 180° together with the spherical excess, without regard to the relations subsisting among the angles of the quadrilaterals or other polygons formed by the lines connecting the angular points. But this mode of proceeding affords a very imperfect solution of the problem: for in order to obtain the best result which can be deduced from the observations, it is indispensable to have regard not only to the condition just named, but to every independent relation subsisting among the angles of the whole series of triangles included [illegible] the survey; and the more numerous the relations are which the observations are made to satisfy, the greater will be the probable accuracy of the final result.

The equations of condition which express the independent relations connecting the angles of a system of geodetical triangles arise chiefly from three sources:—1, The sum of the three angles of each triangle is equal to 180° *plus* the spherical excess; which excess, being in all cases a very small quantity, can be computed to so great a degree of accuracy, that it may be regarded as absolutely exact. 2, If there be a system of triangles so connected that the second has a side a in common with the first, the third a side b in common with the second, the fourth a side c in common with the third, and so on to the last, which has a side k in common with the preceding one, and another side l in common with the first, then, on forming the identical equation

$$1=\frac{a}{l}\times\frac{b}{a}\times\frac{c}{b}\times\frac{d}{c}\ldots\times\frac{l}{k},$$

and substituting for these ratios those of the sines of the angles opposite the respective sides, each being diminished by a third of the spherical excess of the triangle to which it belongs, an equation of condition is obtained which should be satisfied by the observed angles. 3, When the angles observed at any station include the whole circuit of the horizon, their sum must be equal to 360°; but this condition can only be made available when the angles are determined independently of each other.

In a complicated series of triangles, some difficulty may be found in determining the exact number of independent relations furnished by the angles and sides of the figures, but this will be materially lessened by attention to the following considerations:—If a point, P, whose position is still unknown, be observed from two other points, A and B, already determined, and the directions of A and B be also observed from P, we have then three angles for correction, and one equation of condition of the first kind. If the unknown point, P, be observed from three known points, A, B, C, and each of these be also observed from P, we have then five angles for correction, and three equations of condition, namely, two of the first kind, furnished by the two triangles whose vertices are AP, and one of the second: and, generally, when a point P has been observed from m stations whose positions are already known, and each of these has been observed from P, we have then $2m-1$ angles for correction (one at each of the given points and $m-1$ at P), and $2m-3$ independent equations of condition, namely, $m-1$ of the first kind, and $m-2$ of the second.



An example will render this sufficiently clear. Let A, B, C be three points already determined, and P a new station at which the directions of A, B, and C have been observed, and which has itself been observed from those points. These observations give five independent angles to be corrected, namely, two at P, and one at each of the other stations, and three equations of condition, which are thus found:—The two triangles APC and BPC. give two equations of the first kind, namely,

$$1,\ \mathrm{APC}+\mathrm{PAC}+\mathrm{ACP}=180^\circ+\mathrm{E},$$
$$2,\ \mathrm{BPC}+\mathrm{PBC}+\mathrm{BCP}=180^\circ+\mathrm{E}'.$$

On considering the three triangles APB, BPC, ABC, it will be seen that the side PB is common to the first and second, BC to the second and third, and AB to the third and first. Forming therefore the identical equation

$$1=\frac{\mathrm{PB}}{\mathrm{AB}}\cdot\frac{\mathrm{BC}}{\mathrm{PB}}\cdot\frac{\mathrm{AB}}{\mathrm{BC}},$$

and substituting for those ratios those of the sines of the opposite angles (each diminished by one-third of the spherical excess), we get the equation of the second kind:—

$$3,\ 1=\frac{\sin\mathrm{PAB}}{\sin\mathrm{APB}}\cdot\frac{\sin\mathrm{BPC}}{\sin\mathrm{BCP}}\cdot\frac{\sin\mathrm{ACB}}{\sin\mathrm{CAB}}.$$

When the equations of condition have been thus formed, the observed values of the different angles are substituted in them, each being increased or diminished by a small indeterminate correction. The values of the corrections are then determined simultaneously by solving the equations according to the method of *minimum squares*, or so that the equations of condition shall be satisfied as nearly as possible (they cannot be all satisfied exactly), and the sum of the squares of the corrections shall be a minimum. For further details on this subject, and examples of the application of the theory to trigonometrical surveys, we must content ourselves with a reference to the 'Supplementum Theoriæ Combinationis,' &c. of Gauss (Göttingen, 1828), where it is applied to a portion of the triangles surveyed by Krayenhoff in Holland; to Nos. 121 and 122 of the 'Astron. Nachrichten,' where it is applied by Rosenberger to Maupertuis's measurement in Sweden; to No. 438 of the same work, where it is applied by Bessel to the computation of the triangles at the southern extremity of the French arc of meridian; and to the 'Gradmessung in Ost-Preussen,' already referred to. The advantages of this method are twofold. In the first place there is the probability that the result is *nearer* the truth than if it had been deduced in any other way; and secondly, a general and uniform process of calculation is substituted for an imperfect and arbitrary one.

In proceeding according to the ordinary method, and regarding the triangles as independent of each other, the process is much simpler. The difference between the sum of the three observed angles and 180°+E is the aggregate error of the three determinations. If each angle was determined by an equal number of equally good observations, the probable error would be the same for each, and the correction would be properly made by dividing the aggregate error equally among the three. If the observations are assumed to be equally good, but each of the angles has been determined by a different number, then the portion of the aggregate error which should be thrown upon each angle is reciprocally proportional to the number of observations by which it was determined; but when the individual observations are not equally good (and this is the general case) the distribution of the aggregate error should be made in such a manner that the amount of the correction to be applied to each angle is proportional directly to the sum of the squares of the differences between each observation and the arithmetical mean of the whole, and inversely as the square of the number of observations by which the angle was determined. If an angle has been determined by a single reading, the portion of the aggregate error to be assigned to it may be made proportional to the *mean square* (*i. e.* the sum of the squares of the differences from the mean divided by the number of observations) of the errors of a series of observations at one of the other angles made under similar atmospheric circumstances. Such is the method which the theory of *probable errors* indicates; but in most of the geodetical surveys which have yet been published, the distribution of the aggregate error among the three angles has been made, as already remarked, according to some arbitrary hypothesis.

The three angles of the triangle, corrected in the manner now described, are regarded as the true geodetical angles, or rather as the spherical angles formed by the arcs of the great circles which intersect in the verticals passing through the stations on the surface of the osculating sphere. In strictness there are no practical means of determining the true geodetical angles, *i. e.* the angles made by the shortest lines on the spheroid. The observed angle is not the geodetical angle, but the angle made by the two planes which intersect in the vertical of the station, and pass through the remote signals.

Calculation of the Sides.—The method of computing the sides which first suggests itself is, to convert the given or known side into degrees of a circular arc, whose radius is equal to that of the earth, and apply the formulæ of spherical trigonometry. This method has been sometimes adopted; but as it gives rise to tedious calculations, it is usual to have recourse to more expeditious processes, which, though only approximative, give equally exact results. Various methods of approximation have been proposed, though there are only two which have been much used. One of them is the method which has been exclusively followed in the Ordnance survey, so far as published, and also, generally, by Delambre. It consists in deducing from the spherical angles the corresponding angles formed by the chords, and then computing the triangle by plane trigonometry. In this manner the chords of the two unknown sides are found, from which the sides themselves are easily deduced. The formulæ are as follows:—

Let the three spherical angles (*i. e.* the observed angles corrected for the errors of observation) be denoted by A, B, C; the sides respectively opposite by a, b, c (expressed in feet); and the radius of curvature of the surface by r (also in feet). Let A′ be the angle formed by the chords of the sides b and c, and suppose $\mathrm{A}-\mathrm{A}'=x$ seconds; then putting $\omega=206264''\cdot 8$,

$$x=\frac{\omega}{16}\left(\frac{b+c}{r}\right)^2\tan\tfrac{1}{2}\mathrm{A}-\frac{\omega}{16}\left(\frac{b-c}{r}\right)^2\cot\tfrac{1}{2}\mathrm{A}.$$

In like manner if B′ and C′ denote the chord angles corresponding to the spherical angles B, C, respectively, and if we suppose $\mathrm{B}-\mathrm{B}'=x'$, and $\mathrm{C}-\mathrm{C}'=x''$, the two small corrections x' and x'' will be computed from similar exessions to the above, and we have then the three plane igles A′, B′, C′, the sum of which is 180°. For comput- g these corrections approximate values of the sides must previously found; but for this purpose it will generally sufficient to use logarithms to four decimal places.

Although for facility of explanation we have described e reduction to the chord angles as applied to the cor- cted spherical angles, it is manifest that it may be (in actice it generally is) applied to the observed angles. this case we get $A' + B' + C' = 180° \pm$ the aggre- te error of the three observed angles, which error ust be then distributed among the three reduced or ord angles in the manner before described, so that their m may be exactly 180°. By this means, since we have viously $x+x'+x''=E$, the previous calculation of the herical excess, in order to correct the observations, is ndered unnecessary.

When the chords have been computed from the reduced gles A′, B′, C′, the arcs are found in terms of the chords a well-known series, of which it is only necessary to use e two first terms. Let a be a small arc, and a' its chord, en $a = a' - (a'^3 \div 24r^2)$.

The other method of computing the sides to which we ve alluded depends on the following theorem, which was st given by Legendre. If from each of the angles of a herical (or spheroidical) triangle, the sides of which are nall in comparison of the radius, one-third of the spherical ccess be deducted, the sines of the angles thus diminished ill be proportional to the lengths of the opposite sides, so at the triangle may be computed as in plane trigonome- y. As before, let A, B, C be the corrected spherical igles, a, b, c the sides respectively opposite, and E the herical excess; then, if we make

$$A' = A - \tfrac{1}{3}E,\quad B' = B - \tfrac{1}{3}E,\quad C' = C - \tfrac{1}{3}E,$$

e shall have, in virtue of the theorem,

$$b = \frac{a \sin B'}{\sin A'},\quad c = \frac{a \sin C'}{\sin A'},$$

om which formulæ the sides b and c are computed. This ethod therefore requires no greater amount of calculation an would be necessary if the triangles were on a plane rface, excepting that of the spherical excess; and if the ree angles are assumed to be determined with equal curacy, even this is not wanted (unless for the purpose of sting the accuracy of the observations), the angles for lculations being found at once by applying to each of e three observed angles a third of the difference between eir sum and 180°. This is the method which is most equently adopted.

Legendre's theorem will give a sufficiently accurate sult in ordinary cases; but if the triangles are very large, id the utmost precision is aimed at, it will sometimes be sirable to have a closer approximation. This may be tained by computing the angles A′, B′, C′ from the fol- wing expressions of their values, which appear to have en first given by Professor Buzengeiger, in Lindenau's *itschrift für Astronomie*, vol. vi. (Tübingen, 1818), and hich are equivalent to an extension of the theorem so as include terms of the second order, Legendre's approxi- ation including only those of the first. As before, let S the area of the triangle, and $\omega = 206264''{\cdot}8$, then

$$A - A' = \frac{\omega S}{3rr}\left(1 + \frac{aa + 7bb + 7cc}{120rr}\right),$$

$$B - B' = \frac{\omega S}{3rr}\left(1 + \frac{7aa + bb + 7cc}{120rr}\right),$$

$$C - C' = \frac{\omega S}{3rr}\left(1 + \frac{7aa + 7bb + cc}{120rr}\right),$$

nd in consequence of these, the spherical excess E (= A + + C − 180°) becomes

$$E = \frac{\omega S}{rr}\left(1 + \frac{aa + bb + cc}{24rr}\right).$$

It is easy to see that the second terms of these expres- ions must always be very small; in fact, they will amount nly to a few hundredths of a second even in the largest riangles. Nevertheless when the angles are considered s having a mutual dependence, and the corrections for a whole series are determined simultaneously from the equa- ions of condition, the corrected angles will be given (if great precision is required) to three or four decimals of a second, and the above formulæ will have a practical application. They were used by Bessel in the recalculation of the triangles at the southern extremity of the French arc of meridian; and we give them a place the more willingly as they have not hitherto, so far as we know, found their way into any English work.

Professor Buzengeiger has also given a formula for the calculation of the sides of a geodetical triangle, which may be substituted for the method of Legendre, or used for verification. Let a be the known side, A, B, C, the corrected spherical angles, $m = 0{\cdot}4342945$, the modulus of the common logarithms, and $n = m \div 3\omega = 0{\cdot}0000007$, then for computing b and c we have

$\log b = \log a + \log \sin B - \log \sin A + n\,E\,(\cot A - \cot B)$;

$\log c = \log a + \log \sin C - \log \sin A + n\,E\,(\cot A - \cot C)$.

With the help of a small table of natural tangents, this method is scarcely more troublesome than Legendre's. The chord method is more tedious than either, and does not appear to be attended with any corresponding advantage.

Latitudes, Longitudes, and Azimuths.—Having ascertained the terrestrial distances between the several stations, the next step is to determine their geographical positions, or situations with respect to the equator and an assumed first meridian. For this purpose the latitude and longitude of one station at least, and the azimuth of a side of one of the triangles, must be accurately determined by astronomical means; we have then the data that are necessary for computing the geographical position of every other angular point, and the bearing of every other side, through the whole series of triangles, assuming the earth to be a spheroid of rotation of known dimensions and ellipticity. The uncertainty however which always exists respecting the exact form and curvature of any particular portion of the earth's surface, or rather the irregularities of local configuration, require independent astronomical observations, particularly of azimuth, to be made at more stations than one, when the triangulation extends over a considerable tract of country.

If the country included in the survey contains a fixed observatory, this will of course either form one of the principal stations or be connected with the principal triangles, and may be taken as the point of departure. In this case the astronomical position of the fundamental point is known with the greatest certainty; and the meridian-mark of the transit-instrument affords the surest means of determining the bearing of any signal visible from the observatory. At any other station the best method of determining the azimuth is probably to imitate this proceeding, by setting up a temporary mark as nearly in the meridian as may be, and determining its deviation with a transit-instrument by some of the methods used in practical astronomy for the purpose. [TRANSIT INSTRUMENT.] The angle between the mark and the signal at another of the principal stations is then measured with the theodolite, whence the azimuth of the signal becomes known. But as this method cannot always be conveniently followed in geodetical operations, the usual practice is to make the surveying instrument itself subservient to the determination of azimuths. In the English survey the method commonly adopted was, to observe with the theodolite the angle between a flag-staff and the pole-star at its extreme digressions east and west, and to take half the sum of the two angles as the azimuth of the staff. In determining the azimuth in this way a very accurate adjustment of the instrument is necessary. The method usually followed on the Continent has been to observe the angle between a referring signal and the sun, or some star whose place is well known, when near the horizon; and as the azimuth of the sun or star at a given instant of time can be computed with great precision, the observation is liable to no particular cause of error, unless in the determination of the exact clock-time. The result is usually made to depend on the mean of a great number of observations.

The problem on the solution of which the calculation of the geodetical latitudes and longitudes of the stations, and the azimuths of the sides of the triangles, depends is this: Let A and B be two stations whose distance has been determined, and suppose the latitude and longitude of A to be known, together with the azimuth of B as seen from A; it is required to find the latitude and longitude of B, together with the azimuth of A as seen from B. The azimuthal angles are supposed to commence at the south point of the horizon, and to be reckoned towards the west (or right) from 0 to 360°. Assume

$l =$ the latitude of A, $l' =$ the latitude of B,
$\lambda =$ the longitude of A, $\lambda' =$ the longitude of B,
$\theta =$ the azimuth of A B at the station A,
$\theta' =$ the azimuth of A B at the station B,
$d =$ the distance on the spheroid between A and B, in feet.

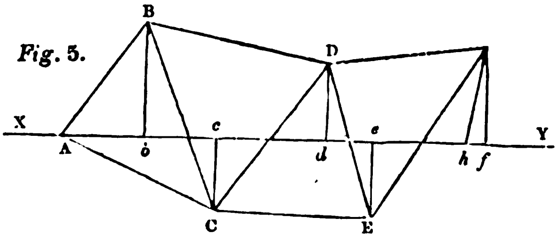
And, as before, let a denote half the greater axis of the meridian, e the eccentricity, $\rho' = a \div \sqrt{(1 - ee \sin^2 l)}$, the radius of curvature of the arc perpendicular to the meridian at A, and $\omega = 206264''{\cdot}8$. Then, putting (for brevity) $u = d \div \rho'$, the differences of the latitudes, longitudes, and azimuths of the two stations, in seconds of arc, are given by the following formulæ, viz.:—

$$l' - l = - \omega\,(u \cos \theta - \tfrac{1}{2} u^2 \sin^2 \theta \tan l)\,(1 + ee \cos^2 l),$$
$$\lambda' - \lambda = \omega\, u \sin \theta \sec l',$$
$$\theta' - \theta = 180^\circ - (\lambda' - \lambda) \sin \tfrac{1}{2}(l' + l) \sec \tfrac{1}{2}(l' - l).$$

These formulæ are only approximative; but they are sufficiently exact for every case that can arise in practical geodesy. Even in the case of the greatest distances between the stations, 100 miles for example, the results which they give will agree with those which are computed from the exact formulæ of spheroidical trigonometry to within a small fraction of a second.

By means of the above formulæ the geographical positions of the principal stations are successively deduced from each other, but when a chain of triangles runs nearly north and south, or east and west, the differences of latitude and longitude are more readily computed by referring the different stations to an assumed meridian by means of parallels and perpendiculars. Let A, B, C, D, E, F be the summits of a chain of triangles, and X Y the direction of the meridian passing through the first point A, and let perpendiculars Bb, Cc, &c., be drawn from each of the other points to XY. Suppose the angle XAB (the azimuth of B on the horizon of A) to be determined by astronomical observations: then, as the angles at B, C, D, &c., are all known from the geodetical observations, the angles which the several sides of the triangles make with XY are easily computed; and the distance on the meridian between the perpendiculars through the extremities of any side is found by multiplying the length of the side into the cosine of its inclination. Hence the distance on the meridian from the point of departure A, to the foot of the perpendicular through any other point, F, is equal to the sum of the sides which join A and F, each multiplied into the cosine of its inclination. Thus the sum of the products of the three sides AB, BD, DF, by the cosines of their respective inclinations, gives $\mathrm{A}b + bd + df = \mathrm{A}f$; or the sides AC, CE, EF, reduced in the same manner, give $\mathrm{A}c + ce + ef = \mathrm{A}f$. Hence the distance from A to the foot of the perpendicular through each point becomes known. In like manner, on multiplying the length of any side into the *sine* of its inclination, we have the difference of the distances of its two extremities from XY, and the distance Ff, of any point F, is the sum of those differences (taken with their proper signs) in respect of all the intermediate sides between A and F. These relations are more shortly expressed by algebraic formulæ. Let the inclinations of three sides intermediate between A and F, for example, AB, BD, DF (the angles at the different points being all reckoned in the same direction), be respectively α, β, γ; then, attention being given to the algebraic signs of the trigonometrical lines, we have

Fig. 5.



$$\mathrm{A}f = \mathrm{AB} \cos \alpha + \mathrm{BD} \cos \beta + \mathrm{DF} \cos \gamma,$$
$$\mathrm{F}f = \mathrm{AB} \sin \alpha + \mathrm{BD} \sin \beta + \mathrm{DF} \sin \gamma.$$

By this means, all the angular points of the series are referred to the meridian of the first, exactly in the same manner as the different points of a curve are referred to its axis by their co-ordinates.

We have now to determine the differences of latitude. Taking the point F for example, let Fh be the arc of the parallel circle on the spheroid, passing through F, and at its intersection with the meridian of A, then Ah (which is always less than Af) is the arc of meridian corresponding to the difference of latitudes. To compute fh we have from the properties of the spheroid, the formula $fh = \mathrm{F}f^2 \tan l' \div 2\mathrm{R}$, in which l' is the approximate latitude of F and R the distance from the centre of the earth; and as fh is always very small, instead of computing the value of R it will be sufficiently accurate to use ρ, the radius of curvature of the meridian corresponding to the latitude. The distance fh thus found is expressed in feet; to convert it into seconds of arc we must multiply by $\omega \div \rho$; hence the difference of the latitudes of F and A, expressed in seconds, is—

$$l' - l = (\omega \div \rho)\,(\mathrm{A}f - fh).$$

The latitude of F and its distance Ff from the meridian of A being known, its longitude, or the arc Fh of the parallel circle, is found from the formula already given. Let ρ' be the radius of curvature of the perpendicular arc Ff, then $(\omega \div \rho')\,\mathrm{F}f$ is the number of seconds in Ff, and hence the difference of longitudes of F and A in seconds is

$$\lambda' - \lambda = (\omega \div \rho') \times \mathrm{F}f \sec l'.$$

When the positions of a considerable number of points are to be determined, the calculations may be facilitated by forming a table of the values of fh corresponding to every value of Ff proceeding by small differences, 100 feet for example. In following this method however the stations must not be so far from the assumed meridian that the difference of the curvilinear distance and its projection on the horizontal plane becomes sensible, and hence in the survey of a large country the direction of a new meridian (or the azimuths) requires to be determined astronomically when the triangulation has been carried a degree or two to the east or west of the point of departure. It is scarcely necessary to add that the positions of the *secondary points* are computed without reference to the curvature, or convergence of meridians.

The method of computing the distance between the parallels of two remote stations, A and F, which we have now described, is that which is usually followed in measuring arcs of meridian. To this purpose, indeed, it is particularly adapted, for as the chain of triangles runs along the direction of the meridian, the distances of the signals from the line to be measured are not so great as to give rise to any error by reason of the neglect of the curvature of the perpendicular arc. For other methods of computing the parts of the meridian, and formulæ, theoretically more exact, for computing the latitudes, longitudes, and azimuths, see Delambre's *Méthodes Analytiques pour la Détermination d'un Arc du Méridien*; or Puissant, *Traité de Géodésie*, 3rd edition, 1842.)

If the earth were a regular spheroid of rotation, the latitudes and longitudes deduced from geodetical measurements commencing with a given observatory would agree exactly (supposing no errors) with those given by astronomical observations. Such agreement however is not found to exist, and no regular figure can be assigned to the earth by which the results of the two methods can be entirely reconciled. An instance or two will suffice to give an idea of the extent to which the discordances may reach. In the remeasurement of Beccaria's arc, the astronomical difference of latitude between Andrate and Mondovi was found to be 1° 7′ 26″.98, while the difference computed from the French triangulation, taking the observatory of Paris as the point of departure, and assuming the ellipticity = 1 ÷ 308·65, was 1° 8′ 14″.82. The discordance amounts to 47″.84, corresponding to a distance on the meridian of about 4880 English feet, the whole distance being about 368,885 feet. Again, the latitude of Venice deduced from that of Rimini by triangulation was found to differ 17″ [illegible] from the latitude given by direct observation; and the latitude of Rimini deduced from that of Milan differed 27″.4 from the astronomical latitude. (*Connaissance des Tems*, 1827.) Similar anomalies have been found in the surveys in England, France, Austria, and indeed all other countries; and as their amount exceeds that which can with any probability be assigned to errors of observation, they are ascribed to irregularities in the direction of gravity arising from inequalities in the form or internal structure of the earth,—to the attraction of mountains or local variations of density. Puissant (*Mém. de l'Acad.*, t. xiv.,

838) shows reason for supposing that in France the curature of the surface is considerably different on the east nd west sides of the meridian of Paris.

Determination of the Altitudes.—In order to complete he description of the objects embraced in a trigonomeical survey, it only remains for us to point out the manner which the relative heights of the stations are observed nd computed. The observations required for this purpose re the zenith distances of the signals as seen from each ther; and they may be made with the theodolite or any strument with which angles can be measured in a vercal plane. The chief difficulty attending the determinaon arises from the uncertainty of the terrestrial refracon, an element which is liable to frequent and considerble variations, more especially as the objects observed are ways near the horizon. The formulæ are as follows:—

Let h and h' denote respectively the heights of two ations, A and B, above the level of the sea; z the zenith istance of B as observed at A; Δz the seconds of arc hrough which B is elevated by the refraction; z' and $\Delta z'$ he corresponding quantities in respect of A as observed at ; C the angle at the centre of the earth formed by the erticals of A and B; d the distance in feet between A nd B on the spheroid; and r the radius of curvature of he terrestrial arc. The plane triangle formed by the two erticals and the straight line which joins A and B gives his analogy:—

$$r+h'+h : h'-h :: \cot \tfrac{1}{2}\mathrm{C} : \tan \tfrac{1}{2}\{z'+\Delta z'-(z+\Delta z)\},$$

rom which, on rejecting superfluous quantities, and with he aid of certain physical assumptions, the formulæ for omputation are deduced.

In the first place, $h'+h$ may be rejected as being insenible in comparison of $2r$: then since $z'+\Delta z'-(z+\Delta z)= \{90°-(z+\Delta z-\tfrac{1}{2}\mathrm{C})\}$, the above analogy gives

$$h'-h=2r\tan\tfrac{1}{2}\mathrm{C}\cot(z+\Delta z-\tfrac{1}{2}\mathrm{C}).$$

Again, because C is always very small angle, we may ut, without sensible error, $d=2r\tan\tfrac{1}{2}\mathrm{C}$. The last formula hen becomes

$$h'-h=d\cot(z+\Delta z-\tfrac{1}{2}\mathrm{C}).$$

With respect to the unknown quantity Δz, two assumpions are made: first, it is assumed that the whole effect of he refraction at both stations is proportional to the disance between the stations, or to the angle C; or to assume $\Delta z'+\Delta z=k\mathrm{C}$, where k is a numerical coefficient. Seondly, it is assumed that the effect of the refraction is he same at both stations, or that $\Delta z'=\Delta z$; this gives $\Delta z=\tfrac{1}{2}k\mathrm{C}$, and consequently $\Delta z-\tfrac{1}{2}\mathrm{C}=-\tfrac{1}{2}(1-k)\mathrm{C}$. Substituting this in the last equation, we get

$$h'-h=d\cot\{z-\tfrac{1}{2}(1-k)\mathrm{C}\}. \qquad (a).$$

This equation gives the height of the signal at B above the place of the instrument at A in terms of the geodetical distance d, and the observed angle z, assuming the coefficient of refraction to be known. It will be observed that C is given in seconds by the formula $\mathrm{C}=\omega d\div r$, where $\omega=206264''\cdot8$.

When the zenith distances are observed at both stations, the coefficient k may be deduced from the observations; for the assumption of $\Delta z'+\Delta z=k\,\mathrm{C}$ gives $k\mathrm{C}=\mathrm{C}+180°-(z+z)$, whence

$$1-k=(z'+z-180°)\div\mathrm{C}. \qquad (b).$$

A mean value of k, deduced in this manner from a number of reciprocal observations, may be substituted in the equation (a) for finding the difference of the heights of two stations when the zenith distance has been observed at one of them only. But when z' and z are both observed, the difference of altitude is obtained independently of the value of k; for on substituting the value now given of $1-k$ in equation (a), we get

$$h'-h=d\tan\tfrac{1}{2}(z'-z). \qquad (c).$$

The absolute height h of the first station is usually found by levelling from the surface of the sea at half-tide. But assuming the refraction to be known, the absolute height of a station may be determined by observation of the zenith distance of the sea horizon. The formula is

$$h=\tfrac{1}{2}r(1+\tfrac{1}{2}k)^2\tan^2(z-90°). \qquad (d).$$

In the application of the preceding formulæ, it is necessary to attend to the height at which the instrument was placed with respect to the signal, or point for which the calculation is to be made. For instance, if the object observed is the surface of the ground, and the instrument is placed at the height of n feet above the surface at both stations, then on computing the coefficient of refraction from the formula (b), the angles z' and z must be each diminished by the number of seconds in the angle subtended by n feet at the distance d, that is, by $206264''\cdot8\,n\div d$. In the formula (c), which applies to reciprocal observations, the height of the instrument need not be regarded, provided it be the same with respect to the signal at both stations. In the cases to which (a) and (d) apply, the correction is made by subtracting the height of the instrument above the ground from the results given immediately by the formulæ.

The surest determination of altitudes is that which is given by reciprocal observations; for in this case the only assumption involved in the formula is, that the refraction is the same at both stations; and if the observations are made under similar atmospheric circumstances, this cannot well be supposed to lead to error. Such observations also give a more certain value of the coefficient of refraction than can be deduced from the astronomical theory, which, besides the hypotheses necessary for connecting the variation of temperature with the altitude, assumes also (for the present purpose) that the variation of temperature follows the same law throughout the whole distance from the one station to the other. The mean value of k, deduced by Bessel from reciprocal observations made during the measurement of the Prussian arc, was 0·1370; Gauss found 0·1306; Caraboeuf, from the French triangulation in Piedmont, 0·1285; Struve, in Russia, 0·1237; Delambre and Mechain, 0·1566; and in the English survey the refraction was usually found to be about 0·08 at each station, which gives $k=0\cdot1600$. This comparatively large coefficient may probably have been owing to the circumstance that the observations were generally made by night, when the refraction is greatest.

We shall conclude this article with a statement of the results of those measures of meridional arcs which appear the most deserving of confidence, and of the elements of the elliptic spheroid of revolution to which they most nearly correspond, as determined by Bessel, in the 'Astronomische Nachrichten,' No. 438 (Altona, 1841). The original data are given in the works to which reference has already been made; but it is necessary to remark that as the sector observations from which the amplitudes of the English and Indian arcs were deduced have been recomputed by Bessel, some slight corrections are made in the latitudes, and the original distances are reduced to British standard feet according to the comparisons of Captain Kater. The distance between the parallels of Mola and Montjouy in the French arc has also been corrected on account of the error above mentioned. We have reduced the distances, which in Bessel's table (as well as the original accounts, excepting those of the English and Indian arcs) are all given in terms of the toise of Peru, into English feet, using the ratio of the toise to the foot given by Captain Kater, in the 'Phil. Trans.' for 1821, namely, 6·39459252 : 1. The normal temperature is that of the toise, or 13° of Réaumur, equal to 61¼° of Fahrenheit. The numbers in the last column show the variations which are required to be made in the observed latitudes given in the second column, in order that the measured arcs may all belong to the same spheroid of rotation. These variations were determined by Bessel, on the principle that the sum of their squares should be a minimum.

	Latitude.	Amplitude.	Meridional Distance in Eng. Feet.	Variations of Latitude.
1. *Peruvian Arc.*				
	° ′ ″	° ′ ″		″
Tarqui	−3 4 32·068			−0·606
Cotchesqui . . .	+0 2 31·387	3 7 3·455	1131047	+0·606
2. *First East Indian Arc.*				
Trivandeporum .	11 44 52·590			−0·271
Paudree	13 19 49·018	1 34 56·428	574318	+0·271
3. *Second East Indian Arcs.*				
Punnæ	8 9 31·132			−1·470
Putchapolliam . .	10 59 42·276	2 50 11·144	1029172	−1·712
Dodagoontah . .	12 59 52·165	4 50 21·033	1756558	+4·016
Namthabad . . .	15 5 53·562	6 56 22·430	2518371	−1·447
Daumergidda . .	18 3 16·245	9 53 45·113	3591779	−0·065
Takal K'hera . .	21 5 51·532	12 56 20·400	4697321	+3·537
Kullianpoor . .	24 7 11·860	15 57 40·728	5794600	−2·850

4. *French Arcs.*

	Latitude.	Amplitude.	Meridional Distance in Eng. feet.	Variations of Latitude.
	° ′ ″	° ′ ″		″
Formentera . . .	38 39 56·11			+0·955
Moutjouy . . .	41 21 44·96	2 41 48·85	982680	+4·115
Barcelona . . .	41 22 47·90	2 42 51·79	988711	+0·764
Carcassonne . .	43 12 54·30	4 32 58·19	1657303	−0·433
Evaux	46 10 42·54	7 30 46·43	2737009	−6·447
Pantheon . . .	48 50 49·37	10 10 53·96	3710863	−1·099
Dunkirk. . . .	51 2 8·85	12 22 12·74	4509832	+2·144
5. *English Arcs.*				
Dunnose . . .	50 37 7·633			−1·816
Greenwich . . .	51 28 39·000	0 51 31·367	318718	+1·396
Bleuheim . . .	51 50 27·632	1 13 19·999	446629	+2·705
Arburyhill . . .	52 13 28·031	1 36 20·398	586361	+1·395
Clifton	53 27 31·130	2 50 23·497	1036409	−3·675
6. *Hanoverian Arc.*				
Göttingen . . .	51 31 47·85			−2·493
Altona	53 32 45·27	2 0 57·42	736425	+2·493
7. *Danish Arc.*				
Lauenburg . . .	53 22 17·046			+0·451
Lysabbel . . .	54 54 10·352	1 31 53·306	559121	−0·451
8. *Prussian Arcs.*				
Trunz	54 13 11·466			−0·907
Königsberg . . .	54 42 50·500	0 29 39·034	180402	−1·448
Memel	55 43 40·446	1 30 28·980	551067	+2·355
9. *Russian Arcs.*				
Belin	52 2 40·864			−1·732
Nemesch . . .	54 39 4·519	2 36 23·655	951588	−2·384
Jacobstadt . . .	56 30 4·562	4 27 23·698	1627702	+1·826
Bristen	56 34 51·550	4 32 10·686	1656903	+2·627
Dorpat	58 22 47·280	6 20 6·416	2313721	−1·044
Hochland . . .	60 5 9·771	8 2 28·907	2937440	+0·607
10. *Swanberg's Swedish Arc.*				
Mallörn	65 31 30·265			+0·560
Pahtawara . . .	67 8 49·830	1 37 19·565	593277	−0·560

The elements of the elliptic spheroid of rotation deduced from the above data, and to which the above variations of latitude correspond, are as follows:—Let a denote half the greater axis of the meridian (or equatorial radius), b half the polar axis, ϵ the ellipticity, and e the eccentricity; then—

$$a = 20923600{\cdot}00, \quad b = 20853657{\cdot}16 \text{ English feet.}$$
$$a : b = 299{\cdot}1528 : 298{\cdot}1528,$$
$$\epsilon = \frac{a-b}{a} = \frac{1}{299{\cdot}1528} = {\cdot}003342773,$$
$$\log ee = 8{\cdot}9122052, \ \log \surd(1-ee) = 9{\cdot}9985458202.$$

These elements agree so nearly as to be almost identical with those adopted by Mr. Airy, in his excellent treatise on the 'Figure of the Earth' (*Ency. Metropolitana*). The coincidence is the more remarkable, as Mr. Airy selected several arcs not included in the above table, and adopted a totally different method of combining them. He gives the equatorial radius = 20923713 feet, and the ratio of the axes 299·33 : 298·33.

On substituting Bessel's elements in the elliptic formulæ for the length of degrees of the meridian and the parallel circles, the following expressions are found:—Let l denote the latitude, m the length in feet of a degree of the meridian between the parallels whose latitudes are respectively $l-\frac{1}{2}$ and $l+\frac{1}{2}$, and p the length of a degree of the parallel whose latitude is l: then

$$m = 364575{\cdot}6 - 1831{\cdot}0 \cos 2l + 3{\cdot}9 \cos 4l -, \&c.$$
$$p = 365491{\cdot}2 \cos l - 305{\cdot}8 \cos 3l + 0{\cdot}4 \cos 5l -, \&c.$$

Length of the quadrant of the meridian = 32811804 feet.

From the above formulæ we have computed the following table of the lengths of degrees of latitude and longitude in English feet:—

Latitude.	Degree of Meridian.	Degree of Parallel Circle.
0°	362748·5	365185·8
10	362858·0	359674·0
20	363173·7	343296·4
30	363658·1	316524·3
40	364254·0	280135·0
45	364575·6	258657·3
50	364889·9	235197·9
60	365489·1	183051·6
70	365978·9	125270·5
80	366299·2	63620·1
90	366410·5	0·0

TRIGONOMETRICAL TABLES. The chronological list given in TABLES will serve as a sketch of the history of these tables: we desire here to elucidate a point of their construction which, in the present state of transition from one sytem of definitions to another [TRIGONOMETRY], causes a great deal of confusion.

In the ordinary trigonometrical tables is set down the common or Brigg's logarithm of the sine, cosine, &c. of every angle which is an exact number of minutes (or seconds, or ten seconds, as the case may be) from 0° to 90°. Looking into a table we find for the logarithm of the sine of 35°, for instance, 9·7585913. This number is the logarithm of 5735764363, a number containing nearly six thousand millions of units. But the constructors of these tables used a radius of ten thousand millions of units, and their assertion consequently is, that if a right-angled triangle have ten thousand millions of units in its hypothenuse, and 35 degrees in one of its angles, the side opposite that angle will be 5735764363, which is correct within one unit. The logarithm of this radius is ten, and the earliest tables were constructed so as to give ten figures of the logarithms, from which ten significant figures of the sine, &c. might always be found: this radius was therefore convenient. Those who use the old system strictly, and employ the radius in every formula, find no difficulty: thus, if c be the hypothenuse of a spherical triangle, and a and b its sides, we have

$$\cos c = \frac{\cos a \, . \cos b}{r}$$
$$\log \cos c = \log \cos a + \log \cos b - \log r \text{ (or 10).}$$

But those who use the old system, and have dropped into the habit of making the radius always unity, or omitting r from the formulæ, and those who use the new system, in which the sines, &c. are numerical representations of ratios, will always find a difficulty, until they establish a new explanation of the characteristic of the logarithms which they find in their tables. We speak of course of beginners, but practice will get over such a discrepancy, or will perhaps cause a sufficient explanation to suggest itself.

To either of the two last-mentioned classes of persons, the sine of 35° is ·5735764363, and its real logarithm is the negative quantity ·7585913 − 1, or − ·2414087. To them therefore the simple explanation of the discrepancy between their logarithm and that of the tables is as follows: —The *tabular* logarithm is always 10 more than the real logarithm, and the real logarithm always 10 less than the tabular logarithm. There are two ways of proceeding: either to take out the real logarithm, which can always be done, using the characteristic − 1 (or for distinction, $\bar{1}$) instead of 9, −8 or $\bar{8}$ instead of 2, −3 or $\bar{3}$ instead of 7, and so on; or to remember that each logarithm is 10 too great, and to make the correction, either mentally or at the end of each logarithm. We have always found the first mode the better of the two, and we should recommend no one to reject it without a sufficient trial.

For example, suppose it required to calculate $\tan \theta = \surd(\sin 1^\circ . \sin 14^\circ \div \sin 3^\circ)^3$. We have (not using the arithmetical complement)

$$\begin{array}{rr}
\log \sin 1^\circ & \bar{2}{\cdot}2418553 \\
\log \sin 14^\circ & \bar{1}{\cdot}3836752 \\ \hline
\text{add} & \bar{3}{\cdot}6255305 \\
\log \sin 3^\circ & \bar{2}{\cdot}7188002 \\ \hline
\text{subtract} & \bar{2}{\cdot}9067303 \\
 & 3 \\ \hline
\theta = 1^\circ\,19' \qquad & 2)\bar{4}{\cdot}7201909 \\ \hline
 & \bar{2}{\cdot}3600955
\end{array}$$

In looking for the result, we remember that the tabular logarithm answering to $\bar{2}$·3600955 is 8·3600955.

The multiplication of the negative characteristic, when it occurs, offers no difficulty, the part carried from the positive decimals being deducted from the product made with the negative figure, instead of added to it. In division however, in order to keep the negative quantity entirely to the characteristic, which is important, the multiple of the divisor chosen, when the negative part is not itself one, should be the one above that negative part, not below it, and the figures necessary to reach that superior multiple should be carried positively to the decimal portion. Thus, when $\overline{10}$·212... is to be divided by 4, the fours in $\overline{12}$ are $\bar{3}$, and the 2 (subtracted from − 10 to give − 12) is now to be added, so that the next step is to put down the fours in 22; after which as usual.

$$\begin{array}{r} 4)\overline{\overline{10}\cdot212\ldots} \\ \overline{3}\cdot553\ldots \end{array}$$

If it be preferred to use the arithmetical complement, the best mode of proceeding is to make the real logarithm with its sign changed, by subtracting the tabular logarithm mentally from 10. But if we have a tangent in which the characteristic is greater than 10, make the real negative characteristic from the subtraction. As follows:—

$$\begin{array}{rl} \sin 1^\circ & \overline{2}\cdot2418553 \\ \times \sin 14^\circ & \overline{1}\cdot3836752 \\ \div \sin 3^\circ & \underline{1\cdot2811998} \\ \text{add} & \overline{2}\cdot9067303 \end{array} \qquad \begin{array}{rl} \sin 1^\circ & \overline{2}\cdot2418553 \\ \times \sin 14^\circ & \overline{1}\cdot3836752 \\ \div \tan 87^\circ & \underline{\overline{2}\cdot7193958} \\ \text{add} & \overline{4}\cdot3449263 \end{array}$$

Those who would use the *tabular* logarithms must remember that every logarithm is too great by ten, or must write it thus—

$$\log \sin 1^\circ = 8\cdot2418553 - 10$$

the latter being the best plan at first. The additions and subtractions must be corrected by this additional column, and if the result is wanted to be a tabular logarithm, must reduce it to the form A − 10, and must look for A in the tables. When a division is to be made, the characteristic and its correcting follower must both be increased so that the result may still be in the form A − 10. Thus, to extract the fifth root of sin 1°, we must throw the logarithm into the form in the first line following:—

$$\begin{array}{c} 5)\underline{48\cdot2418553 - 50} \\ 9\cdot6483711 - 10 \end{array}$$

TRIGONOMETRY. This word signifies the measurement of triangles, but we might as well attempt to confine geometry within etymological limits, as the science of which we are going to give some account in this article: the measurement of the earth is now only an isolated application of the former; and the measurement of triangles, of the latter.

In the modern division of the mathematical sciences, trigonometry, though still defined in books as the art of measuring triangles, really means the consideration of alternating or periodic magnitude; in which quantity is imagined to go through alterations of increase and diminution without end: that is, ϕx, a function of x, is trigonometrical, when, as x varies through all stages of magnitude (or, in technical language, increases from $-\infty$ to $+\infty$), it takes an infinite number of alternate increases and diminutions. It is perfectly possible to contrive a common algebraic function which shall go through any given number of such changes, a thousand, a million, or more: but without recourse to infinite series, it is impossible to find one in which the number of alternations is unlimited. If the properties of algebraical series were as visible to the unassisted apprehension as those of figure in geometry, it would be seen that the two following series (afterwards known as those for the sine and cosine of x),

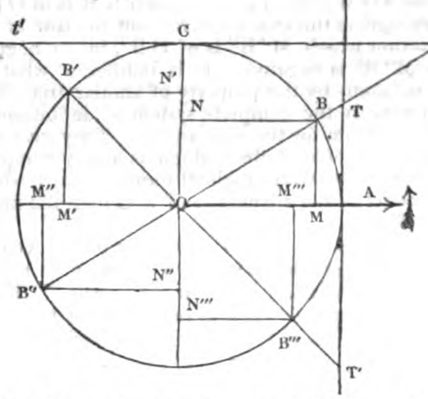
$$x - \frac{x^3}{2.3} + \frac{x^5}{2.3.4.5} - \&c., \text{ and } 1 - \frac{x^2}{2} + \frac{x^4}{2.3.4} - \&c.,$$

are periodic in value: and that, π being a certain incommensurable number ($3\cdot141592\ldots$), all the changes of magnitude that they can possibly take are only repetitions of what take place while x increases from 0 to 2π. We cannot form a more adequate idea of an intelligence superior to that of the human race, than by imagining one to which this truth should be, in consequence of sufficient rapidity of power of computation, a purely elementary one. We are obliged to come by this knowledge through our perceptions of space, and by the application of algebra to geometry; and the construction and use of our alphabet for the expression of periodic magnitude is contained in what are called the elements of trigonometry.

The most simple notion of periodic magnitude lies in supposing that the changes made are purely cyclical, or repetitions of the same for ever: as for instance, those which occur in turning a handle in a vertical plane. The number of revolutions traced out by the handle may be as great as we please, and the quantity of length of the circular arc described by its extremity may be as many times the circumference of the circle as we please, that is, as long as we please: but the distance of the handle from the ground is periodic, exhibiting perpetual increase and diminution as it rises and falls. Hence the circle naturally becomes a sort of standard of reference, and circular motion the primary idea, in all consideration of periodically changing magnitude. The arc, or the angle which it subtends at the centre, is the magnitude which increases without limit, all past revolutions being counted; and the lines which only depend on the position of the moving point in the circle, and not on the number of revolutions by which it has attained that position, are the periodic magnitudes in terms of which all others are expressed.

The periodic magnitudes connected with a varying angle, so far as they have separate designation, are the sine, cosine, tangent, cotangent, secant, cosecant, versed sine, coversed sine, and chord. A change is gradually taking place in the mode of conceiving these quantities, and one which it is very desirable to expedite: though slight in appearance, and producing no difference in results, it gives a great advantage in the consideration of formulæ. These elements *were* lines: they now often *are*, and in time always *will be*, the ratios of lines to lines. The following figure exhibits the old definitions:—

Fig. 1.



Let O be the centre of a circle, and A O B an angle measured from a fixed radius O A, the direction of revolution in which angles are measured positively being denoted by the arrow. From B draw B M perpendicular to O A, and at A and C draw tangents to the circle. Then, in these old definitions, B M is the sine, O M the cosine, A T the tangent, C t the cotangent, O T the secant, O t the cosecant, A M the versed sine, C N the coversed sine, of the angle A O B. If A B should make a complete revolution, so as to come into the same position again, the angle under consideration would now be

four right angles + < A O B,

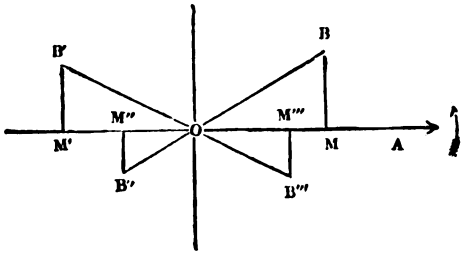
but the sine, cosine, &c. would all be the same as before.

As the line O B moves round, the signs of all these lines are to be taken positively when they are in the same directions as when A O B is less than a right angle. The following table will show them for the angles A O B, A O B′, A O B″, A O B‴, all measured in the same direction of revolution.

Angle.	Sine.	Cosine.	Tangent.	Cotangent.	Secant.	Cosecant.	Versed Sine.	Coversed Sine.
A O B, less than a right angle . .	B M	O M	A T	C t	O T	O t	A M	C N
A O B′, between one and two right angles	B′ M′	− O M′	− A T′	− C t'	− O T′	O t'	A M′	C N′
A O B″, between two and three right angles	− B″ M″	− O M″	A T	C t	− O T	− O t	A M″	C N″
A O B‴, between three and four right angles	− B‴ M‴	O M‴	− A T′	− C t'	O T′	− O t'	A M‴	C N‴

In this system an angle has an infinite number of lines of each sort, one to every radius which can be taken. It is therefore necessary, either to introduce into the formulæ the value of the radius in every case, or to adhere to some one particular value of the radius, which is always understood. The plan usually adopted is first to embarrass the formulæ with the general value of the radius, then gradually to accustom the student to consider the radius as one unit, but to make an exception when trigonometrical tables are used, by considering the radius as ten thousand millions. These inconveniences are avoided in the new system of definitions, which is as follows:—

Fig. 2.



From any point in the line O B (or O B', &c.) which is the variable boundary of the angle, draw B M (or B' M', &c.) perpendicular to O A. Let O M and M B be positive, O M' and M'' B'', &c. negative, as in the usual method of reckoning coordinates. Call B M, B' M', &c. opposite to the angles, O M, O M', &c. adjacent; and let O B, O B', &c. be called hypothenuses (and always considered positive). Then the sine of B O M is the fraction which B M is of O B, with its proper sign, in this case positive: but the sine of A O B'' is the fraction which M'' B'' is of O B'', taken negatively, because M'' B'' is negative. It is indifferent what hypothenuse is taken, by the property of similar triangles, and the following is the complete system of definitions, with the values written for the four angles. They give a slight degree more trouble at first, which is amply compensated in the superior ease with which all formulæ may be deduced, to say nothing of the advantage of avoiding the indefinite radius.

Definition.	A O B	A O B'	A O B''	A O B'''
Sine $= \frac{\text{Opp}^{\text{e}}\text{. side}}{\text{hypothen.}}$	$\frac{BM}{BO}$	$\frac{B'M'}{B'O}$	$-\frac{B''M''}{B''O}$	$-\frac{B'''M'''}{B'''O}$
Cosine $= \frac{\text{Adj}^{\text{t}}\text{. side}}{\text{hypothen.}}$	$\frac{OM}{OB}$	$-\frac{OM'}{OB'}$	$-\frac{OM''}{OB''}$	$\frac{OM'''}{OB'''}$
Tangent $= \frac{\text{Opp}^{\text{e}}\text{. side}}{\text{Adj}^{\text{t}}\text{. side}}$	$\frac{MB}{MO}$	$-\frac{M'B'}{M'O}$	$\frac{M''B''}{M''O}$	$-\frac{M'''B'''}{M'''O}$
Cotangent $= \frac{\text{Adj}^{\text{t}}\text{. side}}{\text{Opp}^{\text{e}}\text{. side}}$	$\frac{MO}{MB}$	$-\frac{M'O}{M'B'}$	$\frac{M''O}{M''B''}$	$-\frac{M'''O}{M'''B'''}$
Secant $= \frac{\text{Hypothen.}}{\text{Adj}^{\text{t}}\text{. side}}$	$\frac{OB}{OM}$	$-\frac{OB'}{OM'}$	$\frac{OB''}{OM''}$	$\frac{OB'''}{OM'''}$
Cosecant $= \frac{\text{Hypothen.}}{\text{Opp}^{\text{e}}\text{. side}}$	$\frac{BO}{BM}$	$\frac{B'O}{B'M'}$	$-\frac{B''O}{B''M''}$	$-\frac{B'''O}{B'''M'''}$

Versed sine = unity − cosine
Coversed sine = unity − sine.

The chord has long ceased to be regarded as one of the trigonometrical functions, and is always used in its old sense, as the line joining the extremities of an arc.

We shall now make a collection of the principal trigonometrical formulæ, and properties of the fundamental functions, referring to ANGLE for the modes of measuring angles, to SINE for development of several of the most important points, to SERIES for the expansions of various functions, to MENSURATION and SPHERICAL for the formulæ particularly connected with triangles, and to NEGATIVE QUANTITIES, ROOT, SUBSIDIARY ANGLE, &c. for various other usual applications.

1. No sine nor cosine exceeds unity; no secant nor cosecant is less than unity; a tangent or cotangent may have any value; versed sines and coversed sines are always contained between 0 and 2, both inclusive.

2. With the sines and cosecants must be remembered the succession $++--$; with cosines and secants $+--+$; with tangents and cotangents, $+-+-$. Thus when an angle is in the *third* right angle, or lies between two and three right angles, its cosine is negative, $-$ being the third sign of the succession $+--+$. Versed sines and coversed sines are always positive.

3. With the different functions must be remembered the following series of initial values, being those at the beginning of the several right angles: thus—

$$\sin 0 = 0, \sin (r^t \angle) = 1, \sin (2r^t \angle^s) = 0, \sin (3r^t \angle^s) = -1$$

sine	0	1	0	−1	cosine	1	0	−1	0	tangent	0	∞	0	∞
cosecant	∞	1	∞	−1	secant	1	∞	−1	∞	cotangent	∞	0	∞	0

4. To find a function of any number of right angles increased or diminished by a given angle, take the same function, if the number of right angles be even, its *co-function* (sine for cosine, cosine for sine, &c.) if the number of right angles be odd: put that sign which belongs to the given function in the right angle to which the whole given angle belongs when the increment or decrement is less than a right angle. Thus we have

$$\sin \left(3\frac{\pi}{2} - \theta\right) = -\cos \theta,$$

which is thus obtained: the odd number of right angles ($\frac{1}{2}\pi$ representing a right angle) is a direction to put *cosine* instead of *sine* on the opposite side; now $\frac{3}{2}\pi - \theta$, θ being less than a right angle, falls in the third right angle, and the sine in that right angle is $-$, so that $-\cos \theta$ must be written. The following results should be remembered:—

$$\begin{array}{lll}
\sin \left(\frac{\pi}{2} - \theta\right) = \cos \theta, & \cos \left(\frac{\pi}{2} - \theta\right) = \sin \theta, & \tan \left(\frac{\pi}{2} - \theta\right) = \cot \theta; \\
\sin \left(\frac{\pi}{2} + \theta\right) = \cos \theta, & \cos \left(\frac{\pi}{2} + \theta\right) = -\sin \theta, & \tan \left(\frac{\pi}{2} + \theta\right) = -\cot \theta; \\
\sin (\pi - \theta) = \sin \theta, & \cos (\pi - \theta) = -\cos \theta, & \tan (\pi - \theta) = -\tan \theta; \\
\sin (\pi + \theta) = -\sin \theta, & \cos (\pi + \theta) = -\cos \theta, & \tan (\pi + \theta) = \tan \theta; \\
\sin (2\pi - \theta) = -\sin \theta, & \cos (2\pi - \theta) = \cos \theta, & \tan (2\pi - \theta) = -\tan \theta; \\
\sin (-\theta) = -\sin \theta, & \cos (-\theta) = \cos \theta, & \tan (-\theta) = -\tan \theta
\end{array}$$

5. In the first revolution, θ and $\pi - \theta$ have the same sines and cosecants, θ and $2\pi - \theta$ the same cosines and secants, θ and $\pi + \theta$ the same tangents and cotangents.

6. $\sin \theta \operatorname{cosec} \theta = 1$, $\cos \theta \sec \theta = 1$, $\tan \theta \cot \theta = 1$,

$$\frac{\sin \theta}{\cos \theta} = \tan \theta, \quad \frac{\cos \theta}{\sin \theta} = \cot \theta.$$

7. $\sin^2 \theta + \cos^2 \theta = 1$, $1 + \tan^2 \theta = \sec^2 \theta$, $1 + \cot^2 \theta = \operatorname{cosec}^2 \theta$.

$$\sin \theta = \frac{\tan \theta}{\sqrt{(1 + \tan^2 \theta)}}, \quad \cos \theta = \frac{1}{\sqrt{(1 + \tan^2 \theta)}}.$$

8. If $\tan \theta = \frac{a}{b}$, then $\sin \theta = \frac{a}{\sqrt{(a^2 + b^2)}}$, $\cos \theta = \frac{b}{\sqrt{(a^2 + b^2)}}$.

9. $\sin (\theta + \phi) = \sin \theta \cos \phi + \cos \theta \sin \phi$ | $\cos (\theta + \phi) = \cos \theta \cos \phi - \sin \theta \sin \phi$
$\sin (\theta - \phi) = \sin \theta \cos \phi - \cos \theta \sin \phi$ | $\cos (\theta - \phi) = \cos \theta \cos \phi + \sin \theta \sin \phi$

10. $\tan (\theta + \phi) = \dfrac{\tan \theta + \tan \phi}{1 - \tan \theta \tan \phi}$ $\quad \tan (\theta - \phi) = \dfrac{\tan \theta - \tan \phi}{1 + \tan \theta \tan \phi}$

11. $\sin \theta + \sin \phi = 2 \sin \dfrac{\theta + \phi}{2} \cos \dfrac{\theta - \phi}{2}$ | $\cos \theta + \cos \phi = 2 \cos \dfrac{\theta + \phi}{2} \cos \dfrac{\theta - \phi}{2}$

$\sin \theta - \sin \phi = 2 \cos \dfrac{\theta + \phi}{2} \sin \dfrac{\theta - \phi}{2}$ | $\cos \theta - \cos \phi = -2 \sin \dfrac{\theta + \phi}{2} \sin \dfrac{\theta - \phi}{2}$

12. $\sin 2\theta = 2 \sin \theta \cos \theta$,
$\cos 2\theta = \cos^2 \theta - \sin^2 \theta = 2 \cos^2 \theta - 1 = 1 - 2 \sin^2 \theta$
$\tan 2\theta = 2 \tan \theta \div (1 - \tan^2 \theta)$.

13. $1 + \cos\theta = 2\cos^2\frac{\theta}{2}$, $1 + \sin\theta = 2\cos^2\left(\frac{\pi}{4} - \frac{\theta}{2}\right)$

$1 - \cos\theta = 2\sin^2\frac{\theta}{2}$, $1 - \sin\theta = 2\sin^2\left(\frac{\pi}{4} - \frac{\theta}{2}\right)$

$\frac{1 - \cos\theta}{1 + \cos\theta} = \tan^2\frac{\theta}{2}$, $\frac{1 - \sin\theta}{1 + \sin\theta} = \tan^2\left(\frac{\pi}{4} - \frac{\theta}{2}\right)$

14. $\frac{\sin\phi - \sin\theta}{\sin\phi + \sin\theta} = \frac{\tan\frac{1}{2}(\phi - \theta)}{\tan\frac{1}{2}(\phi + \theta)}$,

$\frac{\sin\phi \pm \sin\theta}{\cos\phi \mp \cos\theta} = \tan\frac{1}{2}(\phi \pm \theta)$

15. If θ be half a right angle, or less,

$\cos\theta = \frac{1}{2}\sqrt{(1 + \sin 2\theta)} + \frac{1}{2}\sqrt{(1 - \sin 2\theta)}$

$\sin\theta = \frac{1}{2}\sqrt{(1 + \sin 2\theta)} - \frac{1}{2}\sqrt{(1 - \sin 2\theta)}$.

16. If n be any integer, and if $(\cos\theta + \sin\theta)^n$ be developed by the binomial theorem into $P_0 + P_1 + P_2 +$ &c., P_0 being $\cos^n\theta$, P_1 being $n\cos^{n-1}\theta\sin\theta$, &c., then $\cos n\theta$ is $P_0 - P_2 + P_4 -$ &c., and $\sin n\theta$ is $P_1 - P_3 + P_5 - \ldots$.

17. Let C_n and S_n stand for the cosine and sine of $n\theta$:

$2\cos^2\theta = C_2 + 1$
$4\cos^3\theta = C_3 + 3C_1$
$8\cos^4\theta = C_4 + 4C_2 + 3$
$16\cos^5\theta = C_5 + 5C_3 + 10C_1$
$32\cos^6\theta = C_6 + 6C_4 + 15C_2 + 10$
$64\cos^7\theta = C_7 + 7C_5 + 21C_3 + 35C_1$
$128\cos^8\theta = C_8 + 8C_6 + 28C_4 + 56C_2 + 35$
$256\cos^9\theta = C_9 + 9C_7 + 36C_5 + 84C_3 + 126C_1$
$512\cos^{10}\theta = C_{10} + 10C_8 + 45C_6 + 120C_4 + 210C_2 + 126$

To change these into corresponding formulæ for powers of $\sin\theta$,

For	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	&c.
Write	S_1	$-C_2$	$-S_3$	C_4	S_5	$-C_6$	$-S_7$	C_8	&c.

Thus $16\sin^5\theta = S_5 - 3S_3 + 10S_1$

$32\sin^6\theta = -C_6 + 6C_4 - 15C_2 + 10$.

18. *De Moivre's Theorem* and its consequences:—

$$(\cos\theta + \sin\theta.\sqrt{-1})^n = \cos n\theta + \sin n\theta.\sqrt{-1}$$

$$\varepsilon^{\theta\sqrt{-1}} = \cos\theta + \sin\theta.\sqrt{-1} \qquad \varepsilon^{-\theta\sqrt{-1}} = \cos\theta - \sin\theta.\sqrt{-1}$$

$$\cos\theta = \frac{\varepsilon^{\theta\sqrt{-1}} + \varepsilon^{-\theta\sqrt{-1}}}{2} \qquad \sin\theta = \frac{\varepsilon^{\theta\sqrt{-1}} - \varepsilon^{-\theta\sqrt{-1}}}{2\sqrt{-1}}$$

If $2\cos\theta = x + \frac{1}{x}$, then $2\sqrt{-1}.\sin\theta = x - \frac{1}{x}$

and $2\cos n\theta = x^n + \frac{1}{x^n}$, and $2\sqrt{-1}.\sin\theta = x^n - \frac{1}{x^n}$

The versed sine is little used and rarely mentioned in formulæ; and the coversed sine is really only invented for analogy's sake.

The term *sine* (the Latin word *sinus*, meaning the bosom) has been the object of much discussion. It was at one time looked on as a barbarism from the Arabic; and some endeavoured to substitute *semissis inscriptæ*, the half of the chord, for it. Others again thought that it was a corruption of *S. Ins.*, the abbreviation of the above. Dr. Hutton asserts that the Arabic word *Jeib*, which is used for the trigonometrical sine in that language, also means the bosom in common language; and we have been told that this is correct: if so, the Latin *sinus* is only the literal translation of the Arabic. The arc representing a bow (from which it gets its name), half of the string, which represents the sine of half the arc, would come against the breast of the archer. The versed sine (*sinus versus*, or turned sine) was called the *sagitta*, or arrow. The terms tangent and secant are derived in an obvious manner from the old definitions.

There is little of the history of trigonometry which can be either usefully or intelligibly separated from that of mathematics in general. Up to the middle of the last century it belonged rather to geometry than to algebra; and even in our own day algebraical trigonometry is not fully established in England, though rapidly making its way. Those to whom trigonometry is only useful as an instrument in the solution of triangles may enjoy the advantage of that specific clearness which geometry gives to the individual proposition in hand, without needing to feel the want of a system which points out the direction of future progress. But those who are to be trained in mathematics for higher views and more difficult applications, must acquire trigonometry in its most algebraical form as a constituent part of the language of algebra, and an element in every step of their future progress. It is worse than useless to attempt, for them, to draw a distinction between algebraical and trigonometrical; the science will now allow that distinction to remain, and will rather demand new modes of expression than dispense with any of the old ones.

There are those who feel sensible of incongruity in combining the fundamental notions of space and number together, and would rather, at any expense of trouble, keep them separate, except when they are formally united for any particular application. This feeling has our sympathy; and if it were possible to present a complete algebra, both in definitions and processes, without recourse to trigonometrical language, we should willingly agree to the separation. But hitherto it is not so: the only view of algebra in which there is nothing *impossible* is [NEGATIVE, &c. QUANTITIES] essentially joined to space, and particularly to angular magnitude; so that those who would have a perfectly pure algebra must buy it at the expense of unexplained and apparently contradictory symbols.

It would be easy to avoid the notion of space while using the terms of trigonometry and its powerful formulæ. The series at the beginning of this article might be made the definitions of the sine and cosine: or $\sin x$ might be only an abbreviation of $x - \frac{1}{2.3}x^3 +$ &c., and $\cos x$ of $1 - \frac{1}{2}x^2 +$ &c. The fundamental properties of the sine and cosine might easily be proved to belong to these series, without reference to any geometrical reasoning.

TRIGONOSE'MUS, Mr. König's name for a genus of BRACHIOPODA (*Terebratula* of authors), the shell of which has one valve produced into a long perforated beak, truncated at its apex. (Fossil.)

TRIGONOTRE'TA, Mr. König's name for a genus of BRACHIOPODA (*Terebratula* of authors), with a shell which has the hinge of the larger valve produced into a triangular disk, divided by a triangular central foramen. The *Spirifer* of Sowerby belongs to this genus.

TRILLER, DANIEL WILLIAM, a learned and laborious German physician, was born at Erfurt, the 10th of February, 1695. He received his classical education at Zeitz and Leipzig, at which university he afterwards studied medicine. He took his doctor's degree at Halle in 1718, after which he returned to Leipzig and there delivered lectures. In 1720 the town of Merseburg offered him the situation of public physician ('Médecin Pensionné'), which he accepted; in 1730 he made several journeys into Switzerland in the suite of a German prince. Having obtained his dismission at the end of four years, he settled at Frankfort-on-the-Main, which place he left in 1746, in order to settle at Dresden, with the title of physician to the king of Poland. At last the university of Wittenberg bestowed on him a professorship in 1749, which he filled with distinction until his death. He died at the age of eighty-seven, on the 22nd of May, 1782. Triller was a very learned physician, which makes one regret that he did not publish the edition of Hippocrates to which he devoted a great part of his life, and of which he published a specimen under the title 'De novâ Hippocratis Editione Adornandâ Commentatio, ... Speciminis Loco Libellum Hippocratis "De Anatome," .... Commentario perpetuo Medico-critico illustravit, Lugd. Bat.,' 1728, 4to. Abraham Gronovius inserted his notes upon Ælian's 'History of Animals' in his Greek and Latin edition of this author, published at London, 1744, 4to. The judgment passed upon him by M. Goulin, quoted in the 'Biographie Médicale,' is rather severe, though substantially just. During forty years, says he, Triller filled four vols. 8vo. with Latin poems on Medicine: he published dissertations, opuscula, and a mediocre treatise on pleurisy; he disfigured the excellent Pharmacopœia of Wittenberg by overloading it with quotations and notes, in which he often quotes his own Latin poems, and shows, amidst many childish *jeux de mots*, that he was neither a druggist nor a physician. The list of his works (which consist almost entirely of monographs and dissertations) occupy two pages in the 'Biographie Médicale;' of these perhaps the following, relating chiefly to medical antiquities, are some of the most interesting:—'De Moly Homerico detecto, cum Reliquis Argumentis ad Fabulam Græcam pertinentibus,' Leipzig, 1716, 4to.; 'Apologia pro Hippocrate, Atheismi falso accusato,' Rudolstadt, 1719, 4to.; 'Epistola Medico-Critica ad Jo. Freind supra I. et II. Hippocratis *Epidemicorum*, in qua simul agitur de variis ejus Editionibus,' Rudolstadt, 1720, 4to.; 'Conjecturæ et Emendationes in Aretaeum,' first published in the 'Acta Erudit. Lipsiens.,' 1728, p. 101, sq., and afterwards inserted in Boerhaave's edition of that author, Ludg. Bat., 1731, folio, Greek and Latin; 'Succincta Commentatio de Pleuritide ejusque Curatione,' Frankfort, 1740, 8vo.; 'De Veterum Chirurgorum Arundinibus atque Habenis ad Artus male firmos confirmandos adhibitos,' Wittenberg, 1749, 4to.; 'De Fame Lethali ex Callosa Oris Ventriculi Angustia,' Wittenberg, 1750, 4to.; 'De Clysterum Nutrientium Antiquitate et Usu,' Wittenberg, 1750, 4to.; 'De Specificorum, sic dictorum, Remediorum Dubia Fide et Ambiguo Effectu,' Wittenberg, 1751, 4to.; 'De Hippocratis Studio Anatomico Singulari,' Wittenberg, 1754, 4to.; 'De Veritate Paradoxi Hippocratici, Nullam Medicinam interdum esse Optimam Medicinam,' Wittenberg, 1754, 4to.; 'De Scarificationis Oculorum Historia, Antiquitate, et Origine,' Wittenberg, 1754, 4to.; 'De Remediis Veterum Cosmeticis, eorumque Noxiis,' Wittenberg, 1757, 4to.; 'In Locum Plinii de Morbo per Sapientiam Mori,' Wittenberg, 1757, 4to.; 'Dispensatorium Pharmaceuticum Universale,' Frankfort, 1764, 4to.; 'De Morbo Cœliaco singulari à Celso descripto,' Wittenberg, 1765, 4to.; 'Geprüfte Inokulation, ein Gedicht,' Frankfort, 1766, 4to.; 'Opuscula Medica ac Medico-Philologica, antea sparsim edita,' Frankfort, 3 vols., 1766-1772, 4to.; 'Gedicht von den Veränderungen in der Arzneykunst,' Wittenberg, 1768, 4to.; 'De Senilibus Morbis, diverso Modo a Salomone et Hippocrate descriptis atque in se comparatis,' Wittenberg, 1771, 4to.; 'De Variis Veterum Medicorum Ocularioum Collyriis,' Wittenberg, 1772, 4to.

(*Biographie Médicale; Biographie Universelle;* Eloy, *Dict. Hist. de la Méd.*)

TRILOCULI'NA, the name of a genus of microscopic FORAMINIFERA.

TRILOBITES, a race of extinct fossil animals. The older collectors, even of the present day, may remember the curiosity with which 'The Dudley Fossil,' as it was ordinarily termed, was regarded. We ourselves have heard it called by such, proud of their treasure, the Dudley Fossil Insect, and authors who went deeper into the subject than mere gatherers of rarities, had their several notions regarding the place which it occupied in the animal kingdom. By some it was treated of as an insect under the name of *Entomolithus paradoxus;* by others the form was considered as that of an extraordinary *Testacean* with a shell of three lobes; whilst others thought that the trilobitic remains belonged to animals closely approximated to the CHITONS, or, at least, not differing greatly from them.

It is now agreed on all hands that Trilobites are *Crustaceans;* but their place in that class is hardly yet satisfactorily determined; at least those most conversant with the subject hold different opinions upon the point.

Supposed Place in the System.—The very names imposed on some of the genera by modern authors, among whom we may name Brongniart, Dalman, Wahlenberg, Eichwald, Pander, Dekay, and Green, announce the obscurity in which the subjects that they were describing were involved.

Thus we have *Asaphus* (ἀσαφὴς, obscure); *Calymene* (κεκάλυμμένη, concealed); *Paradoxus* (παράδοξος, wonderful); *Cryptonymus* (κρύπτω, to conceal; ὄνομα, a name); *Agnostus* (ἄγνωστος, unknown).

Dr. Buckland (*Bridgewater Treatise*), after quoting the *Rècherches sur les Rapports naturels qui existent entre les Trilobites et les animaux articulés,*' of M. Audouin, expresses an opinion that the nearest approach among living animals to the external form of *Trilobites* is that afforded by the genus *Serolis*. [ISOPODA, vol. xiii., p. 52.] Dr. Buckland thinks that the most striking difference between this animal and the Trilobites consists in there being a fully developed series of crustaceous legs and antennæ in the *Serolis*, whilst no traces of either of these organs have yet been discovered in connection with any Trilobite. Brongniart, he observes, explains the absence of these organs, by conceiving that the Trilobites hold precisely that place in the *Gymnobranchiate* crustaceans, in which the antennæ become very small, or altogether fail; and that the legs being transformed to soft and perishable feet bearing branchiæ, were incapable of preservation.

A second approximation to the character of Trilobites occurs, according to Dr. Buckland, in the *Limulus*, or King Crab (*Xiphosurus*), and he sees a third example of the disposition in *Branchipus stagnalis*. [BRANCHIOPODA, vol. v., p. 343.]

On these views Dr. Buckland founds the following argument:—'In the comparison here made between four different families of crustaceans, for the purpose of illustrating the history of the long-extinct Trilobites by the analogies we find in the Serolis, Limulus, and Branchipus, we have a beautiful example, taken from the extreme points of time of which geology takes cognizance, of that systematic and uniform arrangement of the animal kingdom under which every family is nearly connected with adjacent and cognate families. Three of the families under consideration are among the present inhabitants of the water, while the fourth has been long extinct, and occurs only in a fossil state. When we see the most antient Trilobites thus placed in immediate contact with our living crustaceans, we cannot but recognise them as forming part and parcel of one great system of creation, connected through its whole extent by perfect unity of design, and sustained in its minutest parts by uninterrupted harmonies of organization.

'We have in the Trilobites an example of that peculiar and, as it is sometimes called, rudimentary development of the organs of locomotion in the class crustaceans, whereby the legs are made subservient to the double functions of paddles and lungs. The advocate for the theory of the derivation of existing more perfect species, by successive changes from more simple antient forms, might imagine that he sees in the Trilobite the extinct parent stock from which, by a series of developments, consecutive forms of more perfect crustaceans may, during the lapse of ages, have been derived; but according to this hypothesis we ought no longer to find the same simple condition as that of the Trilobite still retained in the living Branchipus, nor should the primeval form of Limulus have possessed such an intermediate character, or have remained unadvanced in the scale of organization, from its first appearance in the carboniferous series, through the midway periods of the sscondary formations unto the present hour.'

Mr. W. S. MacLeay, in his highly-interesting paper entitled 'Observations on Trilobites, founded on a comparison of their structure with that of Crustacea,' published in Mr. Murchison's work on 'The Silurian System' (1839), after noticing the opinions of Klein and others, who considered the Trilobite to be a kind of molluscous shell with three lobes, and that of Latreille, who, after the abandonment of Klein's supposition as untenable, revived it, and referred the form to Chiton, as above alluded to, remarks, that although Latreille founded his argument on the presumed absence of feet, and on the lateral edges of the body in several species having been coriaceous, it is evident that these animals could not have belonged to the sub-kingdom *Mollusca*, since they possessed compound sessile eyes and a distinct labrum, and must be assigned to the sub-kingdom *Annulosa*, in which are found many articulated animals which have compound eyes and a labrum very similar in structure to those of Trilobites. 'Having a hard shell, apterous tergum and inconspicuous feet,' says Mr. Mac Leay in continuation, 'the Trilobites must have either belonged to the order *Chilognatha*, among the *Ametabola*, or to the class of *Crustacea*. But all the *Chilognatha* are terrestrial animals, and the obvious geological fact is that Trilobites resided in the sea. We must clearly therefore exclude them from the *Chilognatha*, and place them among the *Crustacea*, in which class it now becomes necessary to determine their exact place.'

Mr. MacLeay well observes that the crustaceans, so remarkable above all other animals for the great variation of their feet both in number and form, are divisible into two groups: those in which the eyes are sessile, or the *Edriophthalma* of Leach; and those which have their eyes supported on moveable peduncles, or the *Podophthalma* of the same zoologist. Mr. MacLeay then remarks, that the rilobites clearly belong to the *Edriophthalma*, and that e question is now reduced to determine merely whether ey belong to the *Amphipoda* or those existing *Crustacea* hich do not undergo metamorphosis in their larva state mong which Mr. MacLeay includes not only the *mphipoda* of Latreille, but also his *Læmodipoda* and *opoda*) or whether they belong to the *Entomostraca*, or ose existing *Edriophthalma* which *do* undergo a change form in their larva state. Mr. MacLeay conceives that e Trilobites will be found to differ in so many respects om both the *Amphipoda* and *Entomostraca*, that, accordg to the present state of our knowledge, we must allow em to form a distinct order, intermediate between the ibe *Isopoda* on the one side, and the tribe *Aspidophora* the other.

Mr. MacLeay then reminds the inquirer that those cirmstances which generally are reckoned most anomalous the Trilobites are not in reality so very extraordinary, nce they may be detected in many crustaceans now existg. Thus, he remarks, the trilobed form of the body curs in *Serolis* and *Bopyrus*. The membranous, or ther coriaceous, margin of the body, assumed by Latreille d others to exist in Trilobites, is, Mr. MacLeay serves, to be found in the female *Cymothoæ* [Isopoda, l. xiii., p. 52]; and in these same *Cymothoæ*, as well as the female *Bopyrus*, the eyes disappear, as in many Tribites. 'The compound eyes of *Calymene*,' continues Mr. acLeay, 'are situated on the back of the head, but wide part, and are composed of large facets. The same strucre may be seen in the male of *Cymothoa trigonocephalus*, nd many other *Cymothoadæ*. The absence of antennæ nd the rudimentary state of the feet, both occur in *Bopyus*, the well-known parasite of prawns. In *Sphæroma* e have not only the onisciform body of *Calymene*, but also s property of rolling itself up into a ball. In *Sphæroma* lso we find the large convex semicircular anal segment of *umastus*. I think, therefore, that we can have no hesitaon now in allowing the immediate affinity of the Triloites to Isopod *Amphipoda*, and more particularly to the *ymothoadæ* and that parasitical group which is called *picarides* by Latreille. Indeed, if the Trilobites are once emonstrated to have possessed articulated feet, it will be ifficult to remove a male *Bopyrus* from the group. Here e two eyes are placed on the back of the head and wide part. Here also there are no antennæ, no posterior latel abdominal appendages, and, besides, no very distinct rticulation to the sternum. If the *Bumastus* of Murchison ad a body of thirteen equal segments, with short crusceous feet, it would be a male *Bopyrus*, so close is the ffinity! The differences between a male and female *opyrus*, such for instance as the presence of eyes in the rmer and the want of them in the latter, may also induce s to fancy that similar differences may have possibly ccurred between certain male and female *Trilobita*, which rom their *primâ facie* difference of form are now placed n distinct genera, although they may have truly belonged o one and the same species. *Serolis* has been generally onsidered to come near to *Paradoxides;* but, as the ormer has got four well-developed antennæ with crustaceus feet, and the latter none, I am inclined to believe the elation between them to be one of analogy rather than of mmediate affinity;' and Mr. MacLeay then turns to the *ntomostraca*.

He first addresses himself to the opinion, above noticed, f Dr. Buckland, who, following other authors, has comared, as we have here seen, the Trilobites with the genera *Limulus* and *Branchipus*. With the latter genus, accordng to Mr. MacLeay, the Trilobites have, obviously, no ffinity—an opinion which was to be expected from that art of his argument already set forth by those conversant with the subject; but he admits that it may be well, by eference to *Branchipus*, to show that *Crustacea* can and ctually do exist with soft membranaceous feet, such, he observes, as Audouin and Brongniart suspected, and Goldfuss has more lately asserted, to have been the feet of Trilobites. Taking into consideration, however, the perfect manner in which the soft body of an animal referred to him by Mr. Murchison, and by that gentleman called *Nereites Cumbrensis*, has left its impression on a slaty rock, he finds it difficult to understand how the vestiges of legs in a Trilobite (if such legs ever really existed) should not be more evident than Goldfuss has represented them in his plates. In short, Mr. MacLeay considers that the question of feet still remains unsettled, remarking at the same time that if the Trilobites were *Crustacea*, between *Apus* and *Bopyrus*, a fact which he conceives capable of demonstration, they must have been in possession of subabdominal, laminar, oviferous appendages.

We have very little doubt, if any, that this last conclusion, arrived at by clear and just reasoning, will yet be manifested in some fortunate specimen preserving the subabdominal oviferous laminæ. No such specimen could have been seen by Mr. MacLeay, for he goes on in the same philosophical method as follows:—'Now no traces of such appendages remain, consequently we can easily understand how feet of a similar membranous consistency may have disappeared in like manner. I may here observe that Brongniart is certainly wrong in imagining that the *Ogygia Guettardi* had oval oviferous bags like *Cyclops* [Branchiopoda, vol. v., p. 341], for what he considers to be such organs are more probably the membranaceous margin of the abdomen, and, besides, *Ogygia* has no immediate affinity to *Cyclops*.'

We think that Mr. MacLeay has here disposed of the question as far as the presumed affinity of the *Trilobites* to *Branchipus* is concerned: but, with reference to *Limulus*, he admits that its crustaceous, semilunar cephalothorax bears considerable resemblance to that of certain *Trilobites*, such as the genera *Ogygia*, *Asaphus*, *Paradoxides*, &c. He adverts to the reniform compound eyes placed widely apart on the back of the head and consisting of peculiar facets, a magnified figure of which will be found in the forty-fifth plate of Dr. Buckland's *Bridgewater Treatise*, and also notices the indistinct trilobed structure of the superior abdominal shield. But then, he observes, this shield is composed of a number of confluent segments, so as to appear one piece; and, besides the two ocelli, the large crustaceous feet and cheliform antennæ throw, as he remarks, *Limulus* far away from the Trilobites. We must therefore, he thinks, compare them with *Apus* [Binoculus*] and other *Aspidophora*,—animals, which, in his opinion, of all the Entomostraca, appear to have come nearest to the *Trilobita*. 'Here,' continues Mr. MacLeay, 'we have a large clypeiform shell, rounded in front, and posteriorly emarginate, which forms a cephalothorax, on the back of which are situated three eyes. Of these the two largest are lunated, and obviously correspond to the eyes of the *Trilobita*, although they are placed proportionally much nearer each other. It is true they are simple, but so appear to have been the eyes of *Bumastus*. The abdomen divided into many distinct segments, the foliaceous feet, the structure of the front of the cephalothorax, the two rudimentary antennæ, the large labrum and projecting mandibles, all show the affinity of *Apus* to the Trilobites, more particularly to *Asaphus platycephalus*, in a specimen of which, from Lake Huron, Mr. C. Stokes has discovered a subquadrate labrum, which only differs from that of *Apus* in being anteriorly deeply emarginate, while the latter is truncated. Dr. Buckland has compared this organ to that of crabs; but decapod *Crustacea* possess a very different structure, and the thing most like this labrum is to be found among the *Xiphosura*, or, still better, among the *Aspidophora* of Latreille, of which group this naturalist's genus *Prosopistoma* ought more particularly to be compared with Trilobites. I am not aware, however, that any Trilobite has yet occurred with vestiges of ocelli.'

But still there are, in Mr. MacLeay's opinion, characters which distinguish Trilobites from almost all other *Crustacea;* and among these characters he particularly mentions the absence of all lateral, posterior, abdominal appendages. Excepting *Bopyrus* and certain *Læmodipoda*, all the *Amphipoda* possess, he observes, these anal appendages, which are generally styliform, articulated, and two in number. The *Læmodipoda*, however, want, he remarks, these appendages, because the whole abdomen in them has become evanescent, a case totally different from that of Trilobites, which, like *Bopyrus*, have a well-developed abdomen, consisting of many segments. Mr. MacLeay, therefore, considers this deficiency of anal appendages to a well-developed abdomen, when joined with the evanescent feet and the total absence of antennæ, to be characters separating the *Trilobita* from all *Crustacea*, except *Bopyrus;* and he roughly expresses the affinities of the group by the following diagram:—

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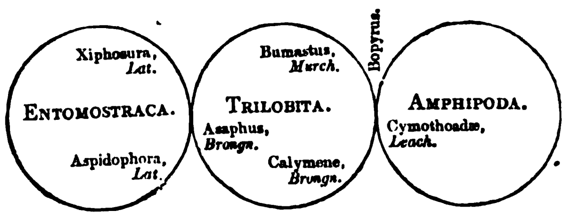
* The figure of *Apus* reversed.



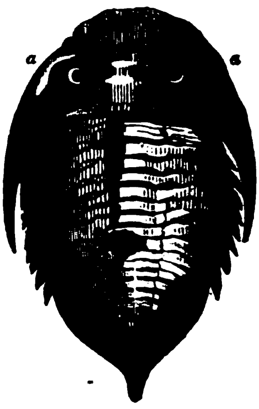
Mr. MacLeay justly observes that if any accuracy be allowed to belong to the foregoing remarks on the affinities of Trilobites, it will follow that the class *Crustacea* may for the present be distributed into orders, thus, viz.:—

Normal Group.	*Orders.*	
PODOPHTHALMA, Leach. Animals having their eyes supported on moveable peduncles.	DECAPODA, Latr.	Antenniferous region of head confluent with the thorax.
	STOMATOPODA, Latr.	Antenniferous region of head distinct from the thorax.
Aberrant Group.	*Orders.*	
EDRIOPHTHALMA, Leach. Animals having their eyes sessile.	AMPHIPODA, Latr.	Head distinct with four antennæ. Feet thick and crustaceous. Animals not undergoing metamorphosis.
	TRILOBITA, Brongn.	Head distinct, without antennæ. Feet rudimentary, soft, and membranaceous.
	ENTOMOSTRACA, Latr.	Head rarely, if ever, distinct from thorax, but provided with antennæ. Feet always distinct. Animals undergoing metamorphosis.

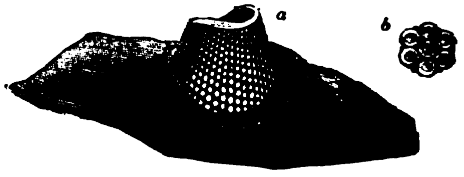
M. Milne Edwards, in his *Histoire Naturelle des Crustacés* (1840), expresses his belief that the *Trilobites* ought to be arranged between the ISOPODA and the BRANCHIOPODA. In all probability they belonged, he thinks, to the great division *Branchiopoda;* but he adds, that in the present state of science this question cannot be entirely resolved, because up to this time nothing positive is known as to the conformation of their feet. They seem to M. Milne Edwards, who takes no notice of Mr. MacLeay's admirable paper, to establish a passage between the *Isopoda* and the *Branchiopoda* on the one side, and the *Xiphosuræ* on the other.

Organization.—M. Milne Edwards states that these animals, composed of a series of rings, much resemble in form many of the *Isopoda* and especially *Serolis.* They present, like those crustaceans, three parts more or less distinct—a head, a thorax, and an abdomen. The *head* is large, clypeiform, ordinarily rounded in front, truncated or concave behind, convex above, and most frequently divided by two depressions or longitudinal furrows into three lobes more or less distinct. This buckler has much analogy with the carapace of *Apus*, only it is less prolonged backwards. In many Trilobites may be remarked tubercles on the upper surface of the head, which, in the opinion of M. Milne Edwards, very much resemble the reniform eyes of *Apus*, and in others exist at the same place two reticulated eyes, which in their disposition recall to the mind of the observer those of *Serolis* and some other Isopods.

Dr. Buckland (*loc. cit.*), in his observations on the *Eyes of Trilobites*, a point, as he says, deserving peculiar consideration, as it affords the most antient and almost the only example yet found in the fossil world of the preservation of parts so delicate as the visual organs of animals that ceased to live many thousands and perhaps millions of years ago, remarks, that we must regard those organs with feelings of no ordinary kind, when we recollect that we have before us the identical instruments of vision through which the light of heaven was admitted to the sensorium of some of the first-created inhabitants of our planet. After referring to the labours of Professor Müller and Mr. Strauss, who have ably and amply illustrated the arrangements by which the eyes of Insects and Crustaceans are adapted to produce distinct vision through the medium of a number of minute facets or lenses placed at the extremity of an equal number of conical tubes or microscopes, amounting sometimes, as in the Butterfly, to 35,000 facets in the two eyes, and to 14,000 in the Dragon-fly,—Dr. Buckland remarks that in eyes constructed on this principle, the image will be more distinct in proportion as the cones in a given portion of the eye are more numerous and long; and that as compound eyes see only those objects which present themselves in the axes of the individual cones, the limit of their field of vision is greater or smaller as the exterior of the eye is more or less hemispherical. The same principles of construction as to form, the disposition of facets, and optical adaptation, are obvious in the eyes of Trilobites.



Back of Asaphus caudatus (Dudley, Mus. Stokes), with the eyes, a a, well preserved. (Buckland.)



a, Side view of the left eye of the same magnified. (Buckland.)
b, Magnified view of a portion of the eye of Calymene macrophthalma. (Hœninghaus.)

According to Dr. Buckland each eye of *Asaphus caudatus* contains at least four hundred nearly spherical lenses fixed in separate compartments on the surface of the cornea, and he observes that the form of the general cornea is peculiarly adapted to the uses of an animal destined to live at the bottom of the water: 'to look downwards was as much impossible as it was unnecessary to a creature living at the bottom; but for horizontal vision in every direction the contrivance is complete. The form of each eye is nearly that of the frustrum of a cone, incomplete on that side only which is directly opposite to the corresponding side of the other eye, and in which, if facets were present, their chief range would be towards each other across the head, where no vision was required. The exterior of each eye, like a circular bastion, ranges nearly round three-fourths of a circle, each commanding so much of the horizon, that where the distinct vision of one eye ceases that of the other eye begins; so that in the horizontal direction the combined range of both eyes was panoramic.' Dr. Buckland then refers to the modifications of the same mechanism in the existing *Branchipus*, *Serolis*, and *Limulus*, according to their habits, and remarks that we find in Trilobites of the transition rocks, which were among the most antient forms of animal life, the same conformation of the eye which is at present adapted to similar functions in the living *Serolis.* The same kind of instrument, he adds, was also employed in those middle periods of geological chronology when the secondary strata were deposited at the bottom of a warm sea, inhabited by *Limuli*, in the regions of Europe which now form the elevated plains of central Germany.

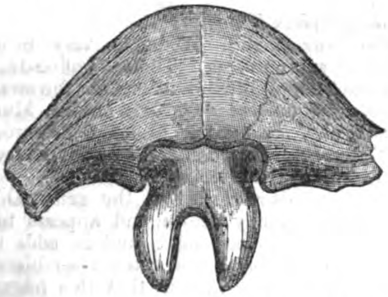
The results arising from these facts are not confined, as Dr. Buckland justly observes, to animal physiology; they give information also regarding the condition of the antient sea and ancient atmosphere, and the relations of both these media to light, at that remote period when the earliest marine animals were furnished with instruments of vision in which the minute optical adaptations were the same that impart the perception of light to crustaceans now living at the bottom of the sea.

Thus much with regard to compound eyes; but, according to Mr. MacLeay, the eyes of Bumastus appear to have been simple, as above noticed, like those of *Apus* and other *Aspidophora*, and, indeed, as he remarks in a note in the paper above quoted, the distinction between smooth eyes and granulose eyes does not seem to be of much importance in these animals; for among the existing family of *Cymothoadæ* we not only see the males of some species with eyes and the females without them, but we observe neighbouring genera, such as *Eurydice* and *Nelocira*, the one with granulose eyes, like a *Calymene*, and the other with smooth eyes like a *Bumastus*. For figures of the eyes of the Barr Trilobite, *Bumastus Barriensis*, Murch., the reader may consult pl. 7 *bis*, fig. 3, *a*, *c*, and pl. 14, fig. 7, of Mr. Murchison's 'Silurian System.'

M. Milne Edwards, addressing himself to the subject of *antennæ*, observes that, as in *Apus*, one perceives no trace of those organs when the Trilobites are seen from above or viewed on their dorsal aspect, and that if any vestiges of those appendages exist, they will probably be found on the lower surface of the head on each side of the mouth, as in the PHYLLOPODA; but he is compelled to admit that no specimen has yet been discovered which showed the slightest trace of them, remarking that there would be nothing astonishing if the antennæ, become already rudimentary and reduced to two in *Apus*, should in the Trilobite be entirely wanting.

The same author calls attention to the sutural lineation, termed by him the *jugal line*, which exists on each side of the upper surface of the head, and is more or less flexuous, springing from the posterior border, passing along the eyes and reaching the frontal edge.

The lower surface of the head is occupied in front by a flat surface, sufficiently resembling, in the opinion of M. Milne Edwards, that which exists in *Apus* and *Limulus*, but which is divided by prolongations of the jugal sutures, into two or three pieces, according as these lines unite on the median line of the front before they are recurved downwards and backwards, or at least remain separated for a more or less considerable space. Behind this region traces of the *buccal apparatus* have been detected, though but little appears to be known relative to its conformation. Dekay, C. Stokes, and Sars have found a plate or lamina bifurcated posteriorly, which, in the opinion of M. Milne Edwards, would seem to constitute a labrum, or epistomian piece analogous to that which gives insertion to the labrum in certain *Isopoda*.



Under-surface of the anterior portion of the shield of *Asaphus platycephalus*, from Lake Huron (Stokes—See *Geol. Trans.*, N. S., vol. i., pl. 27.)

M. Milne Edwards goes on to remark, that extremely incomplete as these notions are, they suffice to convince us that the mouth of the Trilobites must have been organized nearly as it is in the Edriophthalms or Phyllopods, and that it was not formed as it is in the SUCTORIAL CRUSTACEANS, nor as it exists in the *Xiphosuræ*. The second portion of the body or *thorax* (wrongly designated by the majority of authors, in the opinion of M. Milne Edwards as the *abdomen*) immediately follows the cephalic buckler, and is composed of a variable number of very distinct rings. Its upper surface offers nearly always two longitudinal furrows which divide each ring into three lobes, one of which is median or dorsal, and the other two lateral. This division of the thorax into three lobes is so general, that it has been the cause of the name which these animals bear; nevertheless in some of the group (*Nileus armadillo*, Dalm., for example), it is wanting, and, in the opinion of some naturalists, does not essentially distinguish the Trilobites from all the animals of the present epoch: for an analogous disposition is to be seen in a great number of Isopods; only, observes M. Milne Edwards, in these last the median or tergal piece is very large, and the lateral or epimerian pieces are very small, whilst in the Trilobites the contrary ordinarily obtains. The solid teguments which cover the upper part of the thorax are reflected according to the recent observations of Pander, on its lower surface, and prolonged to the level of the furrow situated between the median and lateral lobes, on the dorsal surface of the body; but hitherto, M. Milne Edwards observes, nothing positive has been discovered relative to the disposition of the sternal portion of the thorax, and he thinks it probable that it was membranous, like the feet.

Often, remarks the last-mentioned author, no natural limits exist between the thorax and the posterior or abdominal portion of the body (*post-abdomen* of Brongniart), and this last is composed of rings whose dimensions diminish progressively; sometimes, the *abdomen* (*Pygidium* of Dalman) is very distinct from the thorax, and then is composed of rings of a different form, which are, in certain cases, united by a marginal expansion of a membranaceous appearance, in other cases it is formed of a single buckler similar to that formed by the head, and analogous to the abdomen of *Sphæroma*. [ISOPODA, vol. xiii., p. 56.] At the end of this abdomen there is sometimes a straight and elongated or lamellar appendage which constitutes a species of tail, having some resemblance to that of *Limulus*, or forming a sort of caudal fin. Finally, it would seem that the lateral parts of the lower surface of the abdomen were covered with a solid tegument like the upper surface.

No traces of feet, as we have already seen, have yet been discovered in any Trilobite; but M. Milne Edwards is of opinion that everything leads to the belief that these appendages were membranous and lamellar, as in *Apus*, for in any other view of the case it would be difficult to explain their constant and complete destruction. The same zoologist remarks, that it might even be possible for the latero-anterior division of the lateral pieces in *Ogygia* and some other Trilobites to have been formed by a lobule analogous to that which in *Apus*, *Branchipus*, &c. represents the external branch of the feet, and would seem to serve more particularly for respiration; but he acknowledges that facts are wanting for the solution of this question.

Geological Distribution and Habits.—Dr. Buckland, in his 'Bridgewater Treatise,' speaks of the great extent to which Trilobites are distributed over the face of the globe, and their numerical abundance in the places where they have been discovered, as remarkable features in their history. He notices their occurrence at the most distant points both of the northern and southern hemisphere. 'They have been found,' says Dr. Buckland in continuation, 'all over Northern Europe, and in numerous localities in North America: in the southern hemisphere they occur in the Andes and at the Cape of Good Hope. No Trilobites have yet been found in any strata more recent than the carboniferous series; and no other crustaceans, except three forms which are also Entomostracous,[*] have been noticed in strata coeval with any of those that contain the remains of Trilobites: so that during the long periods that intervened between the deposition of the earliest fossiliferous strata and the termination of the coal-formation, the Trilobites appear to have been the chief representatives of a class which was largely multiplied into other orders and families after these earliest forms of marine crustaceans became extinct.'

Mr. MacLeay adverts to the supposition of some naturalists, that the true Trilobites were parasitical; but he conceives this hypothesis not to be very tenable, since almost all existing articulated parasites that adhere externally to other animals have strong feet, hooked at the end for that purpose. Now, he observes, the Trilobites certainly had no such strong crustaceous hooks to their feet, or these hooks would have been long since detected. The close affinity which, in his opinion, exists between the Trilobites and Bopyrus, will here occur to the reader; but, as he justly remarks, that affinity does not prove a parasitical mode of life: for *Sphæroma* and other *Cymothoadæ* which, like Trilobites, have the power of coiling themselves up like a ball, are not parasitical, although so close in affinity to the parasitical genus *Cymothoa*. 'Nay,' he continues, 'it has been said that the *Cymothoadæ* and *Epicarides* do not draw their nourishment directly from the animals to which they adhere; but, on the contrary, live entirely on the animalculæ brought to them in the water by the play of the branchiæ, near which they always take

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[*] If the opinions of Mr. MacLeay be well founded, the *Trilobita* form a distinct group from the *Entomostraca*.

their post. Still the close connection of Trilobites with *Bopyrus*, and their feet almost null, if not entirely so, induce me to think that these animals must have been to a certain degree sedentary. The flat under-surface of their bodies, and the lateral coriaceous margin of several species, which is so analogous to *Chiton*, make it probable that they adhered with a soft articulated under-side either to rocks or fuci. They appear to have been among *Crustacea* what the *Vermes*, or white-blooded worms, are among *Ametabola*, often without eyes, and always without antennæ or distinct feet. If they had feet, as Audouin and Goldfuss imagine, and as indeed is most probable, they must have been so small, so membranaceous, so soft, and so rudimentary, as almost to be useless to the animal for locomotion. The mouth, so analogous to that of *Apus*, makes us imagine that the Trilobites were carnivorous, and they may possibly have fed on *Acrita*, *Annelida*, or naked *Mollusca*. That they had to search for their food, and that they possessed some small power of locomotion, is to be inferred from their highly organized eyes; for no truly sessile animal is provided with sight.* The *Balanus*, when it becomes sedentary, loses its eyes, as does also, in like case, the female *Coccus*. I imagine therefore that although the Trilobites were to a certain degree sedentary, more particularly the blind ones, they must have had some power of crawling over a flat surface; but whether they moved by rudimentary, soft, membranaceous feet, or whether it was by means of the undulation of setigerous segments, like the earth-worm, or by wrinkling the under surface of the abdomen, like a *Chiton*, are questions yet to be determined. One thing however is, in my opinion, clear, from their longitudinally trilobed form and lateral coriaceous margin, namely, that they had the power of adhering to a flat surface, like a *Chiton*, *Bopyrus*, or *Coccus*. While thus sedentary, the hard, although thin, dorsal shell probably saved them in some degree from the attacks of fishes, just as that of *Chiton* protects such *Mollusca* from all fishes except the *Scaridæ*. The Trilobites probably (like *Ostreæ*, *Chitones*, *Cocci*, and other sedentary animals) adhered in masses one upon the other, and thus formed those conglomerations of individuals which are so remarkable in certain rocks.'

Our limits will not permit us to present our readers with the different systematic arrangements proposed for this extinct race of crustaceans, of which that of M. Alexandre Brongniart appears to have been the first as far as regards their division into different genera; and, indeed, his method appears to form the basis of those of most other naturalists: we therefore select that of M. Milne Edwards (1840), who, after the example of Dalman, divides the *Trilobites* or *Paleades* of that author into two sections:—

Section I. TRILOBITES PROPERLY SO CALLED.

This section comprises nearly all the known species; for, observes M. Milne Edwards, the nature of the *Anomalous Trilobites*, or *Battoïds*, is still rather problematical.

Family 1. *Isotelians.*

Body contractile and very thick. Abdomen very large, scutiform, and without segmentary divisions.

Genera:—1. *Nileus*, Dalman. Thorax unilobated, offering neither distinct longitudinal furrows nor distinct longitudinal divisions.

M. Milne Edwards remarks that the genus *Bumastus* of Murchison (*Silurian System*, part 2, p. 656, pl. 7 *bis*, fig. 3, and pl. 14, fig. 7—*Bumastus Barriensis*) comes extremely near to *Nileus*, and, probably, ought not to be separated from it; for the only important difference which it presents consists in the number of the rings of the thorax, a number which often varies much in groups which are apparently natural. In *Bumastus*, he remarks, there are ten, in *Nileus* eight only; but he acknowledges that in *Bumastus* the eyes are smooth, whilst he describes those of *Nileus* as reticulated. In the present state of our knowledge we would retain Mr. Murchison's genus.

2. *Amphyx*, Dalman. Thorax very distinctly trilobated. Frontal lobe terminated by a very projecting rostriform prolongation: eyes smooth.

3. *Isotelus*, Dekay. Thorax very distinctly trilobated. Frontal lobe rounded in front: eyes granulate. This genus concludes the family of *Isotelidæ*, and is divided by M. Milne Edwards into the following subsections:—

§ 1. Species whose abdominal buckler is hardly trilobated, and presents no transversal furrows even on its median part.

a. Posterior angles of the head rounded.

*a**. Thorax composed of eight segments.

Example, *Isotelus gigas*, Dekay.

*a***. Thorax composed of more than eight rings.

Example, *Isotelus crassicauda* (*Entomostracites crassicauda*, Wahl.; *Asaphus* (*Illænus*) *crassicauda*, Dalm.; *Cryptonymus Rosenbergii*, Eichw.). M. Milne Edwards remarks that *Illænus perovalis* of Murchison (*Sil. Syst.*, p. 661, pl. 23, fig. 7) nearly approaches this species, but has the abdomen as large as the head, and seems to be without eyes.

aa. Posterior angles of the head prolonged backwards so as to resemble pointed horns.

Example, *Isotelus centrotus*.

§ 2. Species whose abdominal buckler is very distinctly trilobated for the greatest part of its length, and presents transverse furrows on the median lobe, or even throughout its length.

b. Lateral angles of the head prolonged into a point.

Example, *Isotelus dilatatus* (*Asaphus dilatatus*, Dalm.

bb. Lateral angles of the head rounded.

Example, *Isotelus Lichtenstenii* (*Cryptonymus Lichtenstenii*, Eichw.).

Family 2. *Calymenians.*

Body very thick, capable of being contracted into a ball. Abdomen large, with distinct segments, and generally much resembling the thorax: eyes very distinct, and nearly always granulate.

Genera:—1. *Asaphus*, Brongn. Abdomen very distinct from the thorax and subscutiform. Thorax very distinctly trilobated; abdomen appearing to be furnished with a submembranous border, or terminated by a membranous prolongation. Thus divided by M. Milne Edwards:—

§ 1. Species the extremity of whose abdomen is prolonged into a point or furnished with a caudal appendage.

Example, *Asaphus caudatus*.

§ 2. Species, the extremity of whose abdomen is rounded.

Example, *Asaphus Debuchii*.

2. *Homalonotus*, König. Abdomen very distinct from the thorax and subscutiform. Thorax unilobate, offering neither distinct longitudinal divisions nor furrows.

Example, *Homalonotus delphinocephalus*, Murch. (*Sil. Syst.*, p. 951, pl. 7 *bis*, fig. 1). M. Milne Edwards observes that the *Trimerus delphinocephalus* of Green does not appear different from this species.

M. Milne Edwards remarks that the genus *Dipleura* of Green is but imperfectly known, and appears to approximate closely to the *Homalonoti*; and he adds that *Nuttainia sparsa* of Eaton bears much resemblance to the head of *Dipleura Dekayii*, but that this fragment of a cephalic buckler seems to be less convex than *Dipleura* and to have the anterior border prolonged and a little elevated in the form of a beak. M. Milne Edwards thinks it impossible to adopt a genus established on a fragment so little characterised.

3. *Calymene*, Brongn. Abdomen differing but little from the thorax and offering neither a distinct membranous border nor caudiform appendage; thorax deeply trilobated.

§ 1. Species, the median lobe of whose head is divided into many lobules.

a. Median lobe of the head at least as wide behind as forward.

Example, *Calymene Blumenbachii*. (*Petrified Insect*. Littleton, *Phil. Trans*, 1750; *Concha Trilobos*, Knorr.)

aa. Median lobe of the head wider before than behind.

Example, *Calymene bellatula*, Dalman.

§ 2. Species, the median lobe of whose head is not divided into lobules.

Example, *Calymene tuberculata*, Murchison.

M. Milne Edwards remarks that the genus *Amphion* of Pander closely approximates *Calymene*, but is distinguished from it by the number of thoracic rings, 20 in number, whilst the abdomen is composed of four segments only; and that the genus *Zethus* of the same author is also a dismemberment of the genus *Calymene*. The species of *Calymene* are numerous. Next to the *Calymenidæ*, M. Milne Edwards places the

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* But see SPONDYLIDÆ, vol. xxii., p. 372.

Family 3. *Ogygians.*

Body very much flattened and apparently not susceptible of being rolled up into a ball. Abdomen in general very small. Eyes very rarely granulated, and often but little or not at all distinct.

Genera.—1. *Pleuracanthus*, M. Edwards. Eyes very large and very distinctly granulate; head moderate, not increasing the thorax, which offers on each side a series of spiniform prolongations; abdomen very little developed.

Example, *Pleuracanthus arachnoïdes* (*Calymene arachnoïdes*, Hœninghaus).

2. *Trinucleus*, Lhwyd. Abdomen large, subscutiform, and composed of many segments. Segments of the thorax less numerous, straight: no distinct eyes.

Though Lhwyd first figured this genus under the name above given and Green subsequently called it *Cryptolithus*, Mr. Murchison has the merit of establishing this generic group; and he observes that had it not been for the previous nomenclature he should have named it *Tetraspis*.

Example, *Trinucleus Lloydii.*

M. Milne Edwards observes that the fossil on which Mr. Murchison has founded the genus *Acidaspis* bears analogy to the head of the *Trinuclei*, but is distinguished from all known Trilobites by the manner in which the median lobe is prolonged posteriorly into a point; the latero-posterior angles are equally acuminated, the anterior border of the head is furnished with a row of small divergent crests, and the lateral lobes are divided into two portions by arched furrows. Of *Acidaspis Brightii*, the single species on which the genus is established, a fragment only appears to be known, which is figured in the *Silurian System*, pl. 14, f. 15.

M. Edwards also remarks that the genus *Ellipsocephalus* of Zenker comes very near to *Trinucleus*, especially to *Trinucleus nudus:* but one species, *Ellipsocephalus ambiguus*, from the grauwacke of Bohemia, is known.

2. *Otarion*, Zenker. Abdomen very small, not scutiform, and composed of a very small number of segments. Body rounded posteriorly, the abdomen not being overpassed by the lateral lobes of the last thoracic rings.

Example, *Otarion diffractum.*

M. Milne Edwards is of opinion that the genus *Conocephalus* of Zenker bears much analogy to *Otarion* and might be united with it.

3. *Ogygia*, Brongn. Abdomen as in *Trinucleus*. Segments of the thorax rather numerous, and curved backwards towards the end; eyes large and smooth.

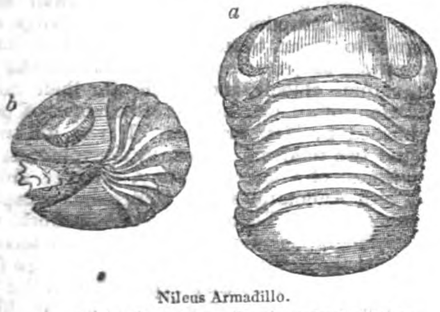
Example, *Ogygia Guettardii.*

4. *Paradoxides*, Brongn. Abdomen as in *Otarion*. Body not rounded posteriorly, and terminated by very large spiniform prolongations, between the base of which is found a small caudal lamina.

Example, *Paradoxides Tessini.*

5. *Peltoura*, Edwards. Abdomen small, but scutiform and without transversal divisions.

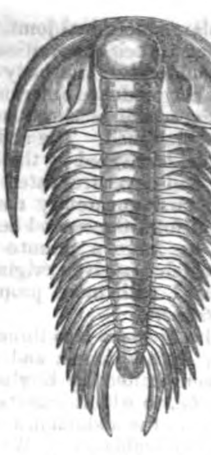
Example, *Peltoura Bucklandii.*



Nileus Armadillo.

a, seen from above; *b*, profile, the animal rolled up.

Calymene Bowningii, partially rolled up.



Paradoxides Tessini.

Trinucleus Lloydii.

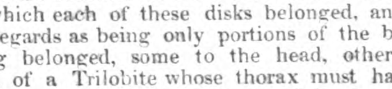
M. Milne Edwards observes in conclusion that the *Ceraurus pleurexanthemus* of Green comes very near to *Paradoxides*, and that the genus *Brongniartia* of Eaton is unknown to him and does not appear to be sufficiently characterised. We here subjoin figures of a few of the true Trilobites.

We would particularly draw the attention of students to the numerous figures and accurate descriptions of Trilobites and of the parts of those crustaceans found in the upper Silurian rocks (Ludlow and Wenlock formations), and in the lower Silurian rocks (Caradoc and Llandeilo formations), published by Mr. Murchison in his valuable and elaborate work on the *Silurian System*.*

Section II. ANOMALOUS TRILOBITES OR BATTOIDS.

M. Milne Edwards remarks that the fossils arranged in this division differ considerably from the Trilobites properly so called, and are as yet but imperfectly known. They are small, nearly circular bucklers, of two kinds, which M. Brongniart considers to have covered the whole of the body to which each of these disks belonged, and which Dalman regards as being only portions of the body, and as having belonged, some to the head, others to the abdomen, of a Trilobite whose thorax must have been reduced to a rudimentary state, or at least must have remained membranous. These two sorts of bucklers or shields have nearly the same form and size, but differ in the disposition of the eminences perceptible on their surface, and are divided into three lobes. The only species known is the *Agnostus* of Brongniart, *Battus* of Dalman.

Example, *Agnostus pisiformis*, *Entomolithus paradoxus*, var. *pisiformis*, Linn.



Agnostus pisiformis. (After Dalman.)

N.B. Mr. MacLeay observes (*op. cit.*) that *Bopyrus* may possibly belong to the *Trilobita*, but he does not see how *Agnostus* can; nor does he believe that the latter fossil has any connection with the *Annulosa* at all.

TRI'MERA, the fourth section of the order Coleoptera among insects, according to the arrangement of Latreille. The insects popularly known as Lady-birds and Puff-ball Beetles are characteristic of the families composing it.

The insects of this division have four palpi, two of which are labial and two maxillary. These palpi are short and slender, or with an enlarged terminal joint. The antennæ are also short and thickened at their extremities, in some species gradually, in others suddenly. The body is oval or hemispheric; the head is not produced anteriorly, and is deeply inserted in the thorax, which is short and transverse, or somewhat square and flattened. The abdomen, generally flat beneath and ample, is covered by the elytra, which are arched, very convex, and never truncated at the tip. The legs are short, with tarsi apparently composed of three joints, but in reality of four, the second being bilobed, and concealing between its lobes a minute third joint, the seeming absence of which has given origin to the name of the section. Westwood, with more propriety, has styled the division *Pseudo-trimera.*

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* 4to., London, J. Murray, 1839.

Latreille divided the *Trimera* into three families, which he styles *Fungicolæ*, *Aphidiphagæ*, and *Pselaphii*. The last has however been united by English entomologists with the *Staphylinidæ*, to which insects their truncated elytra, too short to cover the abdomen, and general aspect, give them a great resemblance. Westwood includes among his *Pseudotrimera*, the *Clavipalpi*, the seventh and last family of *Tetramera* in Latreille's arrangement. He styles the family *Erotylidæ*, from the typical genus *Erotylus*. They are chiefly exotic insects, supposed to feed on vegetable matter; and were regarded by Latreille as connecting the *Cyclica* (*Cassida Chrysomela*) with his trimerous family *Fungicolæ*.

The *Fungicolæ* of Latreille (*Endomychidæ* of British authors) are so styled from their habitat in the interior of cryptogamic plants of the class Fungi, on which they feed. Some species are found under the damp bark of trees, where however their food consists of the Fungi which are peculiar to such a locality. The perfect insect is very convex, oval, and glabrous, and many of the species are ornamented with brilliant colours. The antennæ are composed of eleven joints thickened towards the extremity, and larger than the head and thorax. Their elytra cover the abdomen, and the penultimate joint of the tarsus is deeply bilobed. The only known larva of an insect of this family is that of *Endomychus coccineus*, said by Samouelle to resemble the common glowworm. Curtis figures it. Westwood remarks that it has more analogy to the larva of the *Silphidæ* than to that of the glowworm or of *Coccinella*. The British species of this family belong to the genera *Endomychus* and *Lycoperdina*. They are but few in number. One of them, the *Lycoperdina Bovistæ* is found in great numbers inhabiting that common puff-ball the Lycoperdon Bovistæ. *Eumorphus* is an American genus, described by Weber, distinguished by the dilated flattened three-jointed clubs of the antennæ. It includes several eccentric forms, in which the elytra have broad dilated margins with the anterior tibiæ notched. Mr. Curtis considers them as related to those singular insects which constitute the genus *Mormolyce*, but Westwood regards the relation as one of the most remote analogy.

The *Aphidiphagæ* (*Coccinellidæ* of English authors) are animal-feeders preying upon plant-lice (Aphides), and correspond to the Linnæan genus *Coccinella*. In shape they are very convex and hemispheric, and have antennæ shorter than those of the last family, terminated by a compressed club in the form of a reversed triangle. The larva is depressed, ovate, and fleshy. The three anterior segments of its body are largest, and the abdominal ones tubercled and spotted. Its head is small, with very minute antennæ and thick maxillary palpi. The pupa is found attached by its posterior extremity to a leaf, and undergoes its metamorphosis in that position. The larva emits from its tubercles a yellowish fluid having a disagreeable scent. When the perfect insect is laid hold of, it gives out a similar secretion from its joints, and folds its legs up as if simulating death.

The insects of this family are remarkable for brilliant colouring, being generally red or yellow, with black, red, white, or yellow spots. Individuals of the several species are so extremely variable and different from each other in their markings, as to render the construction of specific diagnoses in this family more difficult than in any other tribe of Coleoptera. Some have supposed that many of these varieties are hybrids between the sexes of different species, but M. Audoin maintains that the eggs produced from the union of allied species in the genus *Coccinella* are sterile. They creep slowly but fly well, and many kinds are gregarious. Their eggs are deposited in yellow patches among the plant-lice, so that the larva is hatched in the midst of its food. They abound in our fields and gardens, and are among the first beetles which come out in spring. They appear sometimes in immense swarms, and spreading over the fields cause needless alarm to the farmer, to whom, far from being a pest, they are a blessing, from the fierce war they wage against his enemies the Aphides.

'In 1807,' says Mr. Kirby, 'the shores at Brighton and all the watering-places on the south coast were literally covered with them, to the great surprise and even alarm of the inhabitants, who were ignorant that their little visitors were emigrants from the neighbouring hop-grounds, where in their larva state each had slain his thousands and tens of thousands of the Aphis, which, under the name of the *Fly*, so frequently blasts the hopes of the hop-grower.'

The peasants in France style them 'bêtes-à-Dieu, honouring their useful qualities; whilst the English name of Lady-bird does homage to their beauty. Some of the species are widely distributed, such as the very common *Coccinella septem-punctata*, which extends its range over all Europe and parts of Asia and Africa. In England we have six genera of *Coccinellidæ*, and more than fifty species.

It is doubtful whether all the insects of this tribe live on animal food. Mr. Darwin has observed them in places where they had no aphides to eat. They are frequently found on the summits of mountains at a very great elevation, as high as 9000 feet; and the species in such places seem to be characteristic of the locality. Aphides are scarce in such situations.

TRIMMER, SARAH, one of the most popular English writers for the instruction of youth, was born at Ipswich, January 6, 1741. Her father, Mr. Joshua Kirby, who is known as the author of 'Dr. Brooke Taylor's Method of Perspective made Easy,' and 'The Perspective of Architecture,' was a man of exemplary piety, and from him she imbibed, at a very early age, the purest sentiments of religion and virtue. When she was about fourteen years old, her parents removed to London, where Mr. Kirby became tutor in perspective to George III., then prince of Wales, and subsequently to Queen Charlotte. Owing to this change of residence, Miss Kirby was introduced to the society of several eminent persons, among whom was Dr. Johnson, who was much pleased with her mental attainments, and presented her with a copy of his 'Rambler.' Being at this time separated from the society of her young associates, she devoted much time to reading and drawing, and obtained a prize from the Society of Arts. About the year 1759 Mr. Kirby removed, with his family, to Kew, upon occasion of his appointment as clerk of the works at the palace at that place; and during his residence there, Miss Kirby became acquainted with Mr. Trimmer, to whom she was married at the age of twenty-one. From that time until the period when she became an author, Mrs. Trimmer was almost entirely occupied with domestic duties and with the education of her numerous family. Her literary labours were commenced about 1780, and were suggested by some of the popular works for the young then recently published by Mrs. Barbauld. A small volume, entitled an 'Easy Introduction to the Knowledge of Nature,' designed to impart to the minds of children information upon various subjects, to induce them to make observations on natural objects, and to elevate their minds to the great Parent of all, was the first of the series of popular works published by Mrs. Trimmer. It was followed, in 1782 and the two following years, by six volumes, issued at various times, of 'Sacred History, selected from the Scriptures, with Annotations and Reflections adapted to the Comprehension of Young Persons;' a work which, observes her biographer, would probably never have been written, had not the author been mother of a large family, since it was the want of an easy explanation of the Scriptures, as experienced by herself in instructing her children, that led her to supply the deficiency. Among Mrs. Trimmer's subsequent publications is a work entitled 'The Economy of Charity,' addressed to ladies, and intended to assist them in the formation and management of Sunday-schools and other charitable institutions. The first edition of this useful work appeared in 1786, and it was soon followed by two others. After it had remained out of print for some years, the author revised and enlarged it, adapting it to the altered state of the institutions to which it refers, and re-published it in 1801. The 'Family Magazine,' a book of instruction principally for cottagers and servants, was carried on for a time by Mrs. Trimmer, about the period of the original publication of the 'Economy of Charity;' and after the magazine was out of print, the principal original papers were collected, and published as 'Instructive Tales.' The 'Adele et Theodore' of Madame de Genlis suggested to Mrs. Trimmer, about the year 1787, the idea of publishing prints representing events in history, accompanied by descriptions; and in this way she illustrated antient history, the Old and New Testaments, and the histories of Rome and England. The great imperfections of the old system of instruction in charity-schools led her to write superior books for their use, to which she obtained the sanction of the Society for Promoting Christian Knowledge. The desire to open the eyes of the public to the mischievous character of various publications for the use of children led to the commencement of a periodical work, called the 'Guardian of Education,' containing essays on Christian education, and reviews of books for the young; but, after it had extended to five octavo volumes, the over-exertion of Mrs. Trimmer in this matter brought on an illness which compelled her to desist from her labour. Since her death, an 'Essay upon Christian Education' has been published separately, extracted from this work. In 1806 appeared 'A Comparative View of the New Plan of Education,' &c., a work designed to show the danger of too generalizing a system of education for the poor, which led to much useful discussion. The last of Mrs. Trimmer's publications was a volume of sermons, selected from the most eminent divines, and adapted for domestic use, under the title of 'Family Sermons.' On the 15th of December, 1810, without any previous illness that could alarm her family, she bowed her head and died in the chair which she usually occupied in her study. In 1814 appeared, in two octavo volumes, an 'Account of the Life and Writings of Mrs. Trimmer,' with many original letters, and copious extracts from her journal, in which, for twenty-five years, she had been accustomed to record her pious meditations. From this work, which is illustrated with a portrait, and was re-published in 1816, the materials of this notice are derived.

TRI'NIA, a genus of plants belonging to the natural order Umbelliferæ, named by Hoffman after Dr. C. B. Trinius, a learned botanist of St. Petersburg, who has devoted himself to the study of the grasses, and published a large work on them, entitled 'Species Graminum.' He has also described the grasses collected by Poeppig in Peru, by Mikan in Rio Janeiro, and those of several other travellers.

The genus is characterised by possessing an obsolete calyx; the petals of the barren plant are lanceolate subemarginate, with a contracted involute point; the fertile flowers have the petals ovate, with a short inflexed point; the fruit is laterally compressed and has an ovate form; the carpels have five prominent filiform equal ridges, of which the lateral ones are marginal; the interstices are without vittæ or nearly so; the seed is gibbous and convex, and the involucres various. The species of this genus, which are not numerous, have been referred to Pimpinella and Seseli, but the diœcious flowers aud the difference between the structure of the petals in the barren and fertile flowers render it very distinct. One ot this species, the *Trinia glaberrima*, Smooth Honewort, is an inhabitant of Great Britain, but must be looked upon as a rarity. It has been found on limestone in Somersetshire, Cornwall, and Devonshire. The whole plant is of a pale glaucous green colour, has remarkable segments of the leaves, which are tripinnate. and no involucre. It appears to be the same plant as the *T. vulgaris* of De Candolle, which is found in the southern parts of Germany, in Switzerland, and Austria.

TRINCAVE'LLIUS, VICTOR (*Trincavella*, or *Trincavela*), was born of a noble family at Venice in 1496. After a careful general education, he went to study at Padua, and thence proceeded to Bologna, where he remained for seven years, and gained such a knowledge of Greek, that, even in his pupilage, his teachers used to consult him on questions of difficulty in interpretation. From Bologna he returned to Padua, where he received the diploma of doctor of medicine; and thence to Venice, where he was appointed to a professorship of philosophy, and obtained the highest reputation, not only in that capacity, but also in the practice of medicine. His fame was greatly increased after his return from the island of Murano, whither he had been sent by the Venetian government to take charge of the sick during an epidemic, and where he showed such skill and courage, that when he came back to Venice he was received with a kind of triumph. In 1551, upon the death of Montanus, he was appointed professor of medicine at Padua, with an unusually large stipend, in consideration of the greater income from practice which he had resigned. He remained at Padua till 1568, when he was sent by the senate to attend a Venetian nobleman who was ill at Udina. His advice was followed by the recovery of his patient, but the fatigue he suffered and the infirmities of age brought on an illness of which he died at Venice in the same year.

The knowledge of Greek which Trincavellius acquired at Bologna and by subsequent study, enabled him to contribute greatly by his commentaries and lectures to the introduction of the works of the writers in that language into the medical schools of Italy, in which, before his time, medicine had been taught almost exclusively from the writings of the Arabian physicians. In his practice however he is said to have followed the doctrines of the Arabian school. All his medical works were published, with the title 'Opera omnia,' in two volumes, folio, at Lyon in 1586, and at Venice in 1599. The chief interest of his writings lies in the completeness of the view which they afford of the medical practice of the time and of the principles on which it was founded; for they contain many observations and letters by others as well as by himself, and many cases and discussions upon modes of treatment. The chief of them are: 'Duæ Quæstiones Medicæ, altera num in lienis adfectibus secanda sit vena, quæ est ad annularem digitum sinistræ manus; altera, utrum in morborum initiis, solum cum materies turget, purgantibus medicamentis uti liceat,' first published at Padua in 1567; and 'Consilia medica post editiones Venetam et Lugdunensem accessione cxxviii. consiliorum locupletata, etc.,' Basle, 1587. In these editions of the 'Opera omnia' are also inserted Trincavellius' commentaries on the antient medical writers, viz.: 'Explanationes in Galeni libros de Differentiis Febrium;' 'In priorem librum Galeni de Arte Curandi;' 'Familiares Exercitationes in primam partem secundi libri Prognosticorum Hippocratis et Galeni;' 'Commentarii in Galeni libros de Compositione Medicamentorum;' 'Explanationes in primam Fen quarti Canonis Avicennæ.' He also in 1534 edited the works of Themistius, translated into Latin by Hermolaus Barbarus, and wrote many notes to them, and translated or edited the commentaries of John the Grammarian on Aristotle, in 4 volumes, folio, in 1535; the 'History of the Expedition of Alexander, by Arrian,' in 1535; the 'Manual of Epictetus,' with the 'Commentary of Arrian,' and the 'Sentences of Stobæus,' in the same year, and the 'Poems of Hesiod' in 1537.

(*Life*, prefixed to the 'Opera omnia,' by Laurentius Marucinus; *Biographie Universelle*; Haller, *Bibliotheca Medicinæ Practicæ*, t. ii., p. 46.)

TRINCOMALEE, a fortified town and harbour on the east coast of the island of Ceylon, in 8° 32′ N. lat. and 81° 21′ E. long., is situated in the north-east corner of Trincomalee Bay. This great inlet consists of Kotiar Bay to the south, Tamblegam Bay to the west, Trincomalee Bay in the centre, Back Bay to the north of Trincomalee Bay, and Inner Harbour to the north of Back Bay, besides several smaller bays and coves. The north part of the bay is formed by a rocky peninsula of irregular shape, which is a continuation of the line of coast from north to south, and is joined to the mainland by a narrow neck. This peninsula is about four miles long, aud for the most part less than half a mile wide: at the south end, towards the sea, it rises perpendicularly 100 feet, with a hill of broken rocks above it 200 feet more: inside, towards the north-west and north, it sinks down; and from the north-east corner a triangular portion shoots out westward into the bay, having Inner Harbour to the north and Back Bay to the south, which, together, form what is properly the harbour of Trincomalee. On this inner and lower part of the rocky peninsula the town and fortifications of Trincomalee are built. Fort Ostenburg, which was built by the Dutch, is situated farther to the south of the peninsula, and commands the entrance to the harbour. The entrance of the bay from the sea is about five miles wide.

The harbour of Trincomalee, which for accommodation and safety is perhaps not surpassed by any in the world, is invaluable to the British as a naval station in the Indian seas. It has room enough for whole fleets; is landlocked by high ridges, and sheltered from all winds; has depth of water for the largest ships; and, what is of most importance, can be entered at all seasons during both monsoons; thus affording a place of shelter, when, from the want of harbours on the east and south-west coasts of Hindustan, vessels are obliged to put out to sea during the violence of the monsoon. A ship from Madras can reach it in about two days.

The town and fortifications of Trincomalee are about three miles in circumference, but this includes much space not built upon. The inhabitants, who are not numerous, are chiefly Hindus from Tanjore and the adjacent coast of Hindustan, with a few natives of Ceylon, and the British troops stationed there. A pagoda, dedicated to Siva, formerly stood on a rocky summit of the peninsula, and the spot is still held sacred by the Hindus. The pagoda was destroyed by the Dutch, and used in the construction of their fortifications. The climate is hot; the mean temperature of the coolest months, when the north-east monsoon prevails (April to October), is about 77°; the mean of the hottest, when the land-wind, or south-west monsoon, blows, is about 83°. There is little export trade, the produce being hardly enough for the wants of the inhabitants, though the adjacent country was once populous, and exported grain and other provisions to the coasts of Hindustan. Many reservoirs and other works for irrigation and drainage are now in ruins and choked up; and swamps, and jungles, and woods, abounding with wild hogs, and buffaloes, and elephants, fill the atmosphere with malaria, and render the climate more unwholesome than the greater part of the rest of the island.

Trincomalee is about 95 miles from Kandy, and 165 miles from Colombo, direct distances. An excellent carriage-road has been carried across the island from Colombo to Trincomalee by the British: it was completed in 1833.

The Portuguese were the first to obtain possession of Trincomalee. The Dutch took it from the Portuguese in 1658, and retained it till 1782, when it was taken by a British fleet, under Sir Edward Hughes, and a body of troops commanded by Sir Hector Monro. Shortly afterwards however it was retaken by the French Admiral Suffrein, who delivered it to the Dutch; they held it till 1795, when it was surrendered, after a siege of three weeks, to the British, who still retain possession of it.

(Hamilton's *East India Gazetteer;* Davy's *Interior of Ceylon;* Forbes's *Eleven Years in Ceylon*, 1840.)

TRING. [HERTFORDSHIRE.]

TRINGA. [TRINGINÆ.]

TRINGI'NÆ. In the article SCOLOPACIDÆ (vol. xxi., p. 84) will be found the general views of authors as to the place of the *Sandpipers* (*Tringa*, Linn.), some of which are arranged under the subfamily *Totaninæ*.

Mr. Swainson, it will be seen on reference to the article *Scolopacidæ*, makes that the family name in his *Synopsis* forming the fourth and last part of his work on *The lassification of Birds;* but, in the third part, he does not seem to recognise this family name, for he uses the term *Tringidæ* instead, and makes it contain the most typical Waders, as the snipes, woodcocks, and sandpipers. This group, he observes, is distinguished from all others by the great length, the slenderness, and the flexibility of the bill, no less than by the delicacy of the legs and the smallness of the hinder toe. Like the plovers, they are, he remarks, endowed with great powers of flight and of locomotion, since they run with vast celerity, and have the faculty in part of both swimming and diving; the bill, he adds, is even longer than the plover's, but instead of its being divided as it were into two portions, as in those birds, the culmen is uninterruptedly straight, and the upper mandible is not suddenly bent downwards. 'The sandpiper or the snipe,' says Mr. Swainson in continuation, 'will give an accurate idea of that general formation which belongs to the whole family. Their geographic dispersion is as wide as their locomotive powers are great. The shores of every part of the world abound with sandpipers and curlews; and the European wimbrel (*Numenius phæopus*) is said to have been detected on the coasts of New Holland.'

Mr. Swainson then briefly notices the genera comprised in this family, observing that the true curlews (*Numenius*) have the same long and generally curved bill which distinguishes the Ibis [TANTALIDÆ], but the cheeks and the throat are covered with feathers. In the AVOSETS (*Recurvirostra*) he sees the most aberrant type of the *Tringidæ*, for its toes are webbed, and he thinks that it probably represents *Phænicopterus* in its own circle. [FLAMINGO.] 'In TOTANUS,' continues Mr. Swainson, 'which comprises many of the European sandpipers, the species are numerous, and many examples occur in Britain,—as the green sandpiper, the spotted snipe, the redshank, and the common sandpiper. This vernacular name is probably derived from the whistling or piping notes which are uttered by these birds as they run on the sands. They are dispersed all over the world, and are perpetually wandering from one locality to another. The toes are generally free, but sometimes in species which lead off to other genera there is a small membrane.'

Mr. Swainson then adverts to the snipes (*Scolopax*) and the woodcocks (*Rusticola*). The true woodcocks, he observes, are found in Europe, America, and Asia; and seem to be further represented in the hot latitudes of the Old World by the elegantly-marked genus *Rhynchœa*. Mr. Swainson concludes by an allusion to the Phalaropes, or 'lobe-foots,' generally placed near the above genera. [SCOLOPACIDÆ, vol. xxi., p. 88.]

In the part (ix.) just out of Mr. Gould's great work on the *Birds of Australia* are beautiful figures of *Rhynchœa australis*, which he found tolerably plentiful during the moist season of 1839 in the district of the Upper Hunter, more particularly in the flats of Segenho, Aberdeen, Scone, &c. 'Although,' says Mr. Gould, 'I did not succeed in finding its nest, no doubt exists in my mind of its breeding in the immediate locality, as, on dissecting a female, an egg was found in the ovarium nearly of the full size, and ready to receive its calcareous covering or shell. In its habits and disposition this bird partakes both of the true snipe and sandpiper: it neither lies so close, nor has it the crouching manner of the true snipes, but exposes itself to view like the sandpipers, running about either among the rushes or on the bare ground at the edge of the water: on being disturbed, those I saw generally flew towards the brush, seeking shelter among the low bushes, from which they were not easily driven or forced to take wing. It flies straighter, slower, more laboured, and nearer to the ground than the true snipes. Considerable confusion has always existed respecting the members of the group to which this bird belongs, the opposite sexes of the same species having been described as distinct; from actual dissection, however, of numerous examples, and from seeing these birds mated in a state of nature, I am enabled to affirm that the figures in the accompanying plate are accurate representations of the male and female. This species will be found on comparison to possess, among other characters, much shorter toes than the Indian and Chinese species, to which it is most nearly allied. On dissection I also observed an anatomical peculiarity of a very extraordinary nature, the more so as it exists in females alone. I allude to the great elongation of the trachea, which passes down between the skin and the muscles forming the breast for the whole length of the body, making four distinct convolutions before entering the lungs. On discovering this extraordinary formation, I immediately placed the body in spirits for the examination of my friend Mr. Yarrell, who, as is well known, has paid great attention to this part of the organization of birds, and who informs me that the position and form of the trachea in *Rhynchœa australis* is similar to that of the semi-palmated goose figured in the 15th volume of the *Trans. Linn. Soc.*, tab. 14. The cranes, swans, guans, &c. present us with species having the trachea singularly developed, several of them with extensive convolutions before entering the lungs; some with a receptacle for its folds within the cavity of the keel of the breast bone [SWANS], while in others it is situated outside the pectoral muscles, immediately beneath the outer skin of the breast; but in no instance is it more extensively or more curiously developed than in the present bird. The use of this conformation, so exclusively confined to one and that the female sex, I could not in any way discover or surmise. No note whatever was heard to proceed from either sex, while on the wing or when flushed.'

In the same part are accurate figures and descriptions of the beautiful *Recurvirostra rubricollis*, or *Red-necked Avoset*, the *Ya-jin-goo-rong* of the aborigines of the owland districts of Western Australia: the favourite ocalities of the species, according to Mr. Gould, are the akes in the neighbourhood of Perth and on Rottnest sland, where it is seen in small flocks in company with he *Himantopus leucocephalus*. [PLOVERS, vol. xviii., . 286.] In South Australia, the river Murray and the hores of the lake Alexandrina afford situations equally dapted for its existence, according to the same author.

But we must here turn our attention to those smaller orms more generally known vernacularly under the name f 'Sandpipers:' the species are numerous, but our limits vill only permit us here to notice one or two, which may onvey to the reader a general impression of the contour f the group when added to the marsh sandpiper (*Totanus agnatilis*) figured and described in the article SCOLOPAIDÆ (vol. xxi., p. 86).

Mr. Yarrell makes the Curlew Sandpiper, *Numenius ygmæus*, or *Pigmy Curlew* of Pennant, the step between he snipes properly so called and the sandpipers, observing hat it leads by an easy gradation to the true sandpipers, or marine snipes, most of which, as their name implies, freuent and obtain their living on the sandy shores of the ea.

The species last named, the Green Sandpiper (*Tringa chropus*); the Wood Sandpiper (*Tringa glareola*); the Common Sandpiper (*Tringa hypoleucos*); the Spotted Sandpiper (*Tringa macularia*) (which four last belong to he genus *Totanus* of modern authors); the Knot; the Buff-breasted Sandpiper (*Tringa rufescens*); the Broad-billed Sandpiper (*Tringa platyrhyncha*); the Little Sandpiper, or Stint; Temminck's Stint (*Tringa Temminckii*); Schinz's Sandpiper (*Tringa Schinzii*); the Pectoral Sandpiper (*Tringa pectoralis*); the Dunlin (*Tringa alpina*); nd the Purple Sandpiper (*Tringa maritima*),—are British.

We select as examples the Knot and the Little Sandpiper; and first, of

The Knot.—'*Description.* (*Male and Female in Winter*). —Bill straight, a little longer than the head, very much diated and convex towards the tip; all the tail-feathers of equal length. Throat, middle of the belly, and abdomen pure white; forehead, eyebrows, sides and front of the neck, breast and flanks white also, but varied with small, brown, longitudinal lines, and transversal and zigzag bands f ashy brown; head, neck, back, and scapulars bright ash vith brown stems; rump and upper tail-coverts white vith black crescents and zigzags; wing-coverts ash, borered with white and with brown stems; tail-feathers ash variegated with white; bill and feet greenish black; iris brown. Length about ten inches.

Young of the Year before the First Moult.—The ash-colour of the back and scapulars very deep; all these feathers terminated by very narrow crescents, the upper of which is black and the lower white; a multitude of great brown spots are disposed longitudinally on the top of the head and on the nape, the ground-colour of which is ash; a slight tint of reddish grey upon the breast; a brown stripe between the eye and the bill, which last is greenish ash; the rest like the winter plumage of the adults.

Young at their First Spring Moult.—All that is of a coppery ruddy colour in the old birds, is bright red in the young when nine months old; nape and top of the head yellowish ash, with longitudinal brown lines; the bright ruddy and the blackish mingled on the upper part of the back; oval spots of the scapulars very bright ruddy; middle of the belly, and sometimes the breast, variegated with white feathers, which are spotted with brown. More ash-coloured feathers on the upper parts, and more white feathers on the lower parts.

Summer or Nuptial Plumage.—Large eyebrows, throat, sides and front of the neck, breast, belly, and flanks of a rusty or coppery ruddy; nape ruddy with small longitudinal lines; top of the head, back, and scapulars deep black; all these feathers bordered with vivid ruddy; on the scapulars great oval spots of the same ruddy colour; abdomen white, speckled with ruddy and blotched with black; upper coverts of the tail white with black crescents and ruddy blotches; tail-feathers blackish ash, variegated with whitish. Such are the old birds when in perfect plumage. (Temm.)

This is the Tringa *cinerea*, *grisea*, and *Canutus* of Linnæus and Gmelin; *Calidris Canutus* of Cuvier; the *Maubèche grise*, *Maubeche Tachetée*, and *Le Canut* of the French; *Chiurlo*, *Piovanello maggiore*, and *Paginella maggiore* of the Italians; *Rothbraune Strandlaufer*, *Aschgraus Strandlaufer*, and *Hochköpfige Strandlaufer* of the Germans; *Sidlingar-Kall* of the Icelanders: *Ficere Pist*, *Ficere-Kuro*, and *Ficer-Muus* of the Norwegians; *Y Cnut* of the antient British; *Knot* of the modern British.

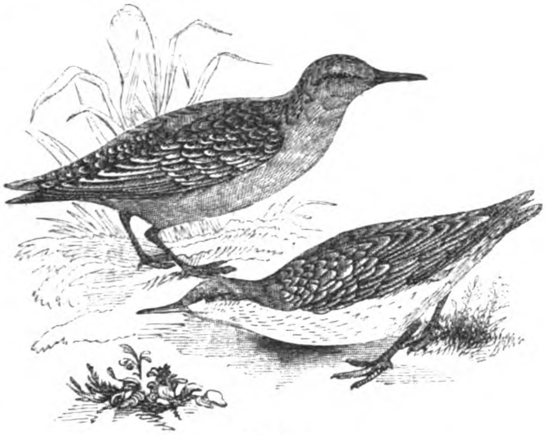
Several other scientific names have been given to the bird according to the different stages of its plumage, such stages having been mistaken by the describers for specific differences. (See Temminck's *Manual.*)

Geographical Distribution.—Iceland, Greenland, North Georgian Islands, Duke of York's Bay, Melville Peninsula (where they were seen breeding), Hudson's Bay (where it breeds), and down to the fifty-fifth parallel Sweden and Norway, Holland in spring and autumn, the British Islands (but not known to breed there), rare in Germany, France, and the south of Europe. The Prince of Canino does not notice it in his *Specchio Comparativo*.

Nest, Habits, Food, &c.—According to Captain Lyon, who saw it breeding in Melville Peninsula, the Knot lays four eggs on a tuft of withered grass, without forming any nest. The eggs are of a light yellowish brown, spotted with grey and reddish at the larger end, so as to form a sort of zone more or less: there are but few spots towards the point. In the autumn the Knots appear on the eastern coasts of England in great numbers, and are to be found also in most of the southern counties. They are regular visitors to Ireland. Mr. Yarrell states that he is not aware of any record of the Knot breeding in the British Islands, nor does he know of any British collection that contains its eggs.

The food of the Knot consists principally of worms, and also, occasionally, of small river and marsh insects, little marine crustaceans and very small bivalve mollusks.

Utility to Man.—One of the most delicious of birds, and, when fattened, preferred by epicures to the luscious ruff. 'They are taken,' says Pennant, 'in great numbers on the coasts of Lincolnshire, in nets such as are employed in taking ruffs; with two or three dozen of *stales* of wood painted like the birds, placed within: fourteen dozen have been taken at once. Their season is from the beginning of August to the end of November. They disappear with the first frosts. Camden says they derive their name from King Canute, Knute, or Knout, as he is sometimes called; probably because they were a favourite dish of that monarch. We know that he kept the feast of the Purification of the Virgin Mary with great pomp and magnificence at Ely, and this being one of the fen birds, it is not unlikely that he met with it there.'



The Knot.

Upper figure, summer plumage; lower figure, winter plumage. (Gould.)

In the 'Northumberland Household-Book,' 'Knottes' are among the birds admitted to his lordship's table, and the charge for them is noted at one penny. Mr. Yarrell remarks that the greater portion of the autumnal visitors to the eastern and southern counties of England are young birds that have come northward from the breeding-grounds, and that the London markets exhibit a good supply throughout the winter. A male in perfect plumage was, he says, obtained in 1820 from Yarmouth, so late in the season as the 25th of May, and he quotes the 'Norfolk Household-Book,' which commences in 1519, for various records of rewards to the fowler for bringing in Knots, as a proof of the high estimation in which they were then held. Nor is Drayton silent as to the fame of the species:—

> 'The Knot, that called was Canutus bird of old,
> Of that great king of Danes his name that still doth hold,
> His appetite to please, that farre and neere was sought,
> For him, as some have said, from Denmarke hither brought.
> (*Polyolbion*—the five-and-twentieth Song.)

The Little Sandpiper:—Description.—Bill straight, shorter than the head; tail doubly forked; lateral feathers brown-ash, all variegated with white; tarsus ten lines long.

Male and Female in Winter Plumage.—All the upper parts ash-coloured, and with blackish brown along the stems; sides of the breast ashy-ruddy; a brown stripe between the eye and the bill; middle of the breast, throat, eyebrows, front of the neck, all the lower parts, but only the lateral feathers of the upper coverts of the tail, pure white; lateral tail-feathers ashy-brown, all variegated with white, the two middle ones brown; bill and feet black. Length about six inches.

Young before the first moult.—Feathers of the top of the head blackish, bordered with yellowish ruddy; forehead, eyebrows, throat, front of the neck, middle of the breast and the other lower parts pure white; a brown stripe between the eye and the bill; sides of the breast inclining to ruddy varied with ashy-brown; feathers of the back, scapulars, and wing-coverts blackish-brown, those of the upper part of the back surrounded by a wide ruddy border, those of the scapulars by a wide yellowish white border, and those of the wing-coverts by a narrow band of yellowish ruddy; the two middle tail-feathers bordered with ruddy-ash, the others variegated with white.

Summer or Nuptial Plumage.—Top of the head black, with spots of vivid ruddy. Cheeks, sides of the neck, and sides of the breast bright ruddyish sprinkled with small brown angular spots; eyebrows, throat, middle of the breast and all the lower parts pure white; feathers of the back, scapulars, wing-coverts, rump and two middle tail-feathers deep black; all with a large border and terminated by bright ruddy; only the lateral feathers of the upper coverts of the tail white with isolated spots; all the lateral tail-feathers ashy-brown, but variegated with pure white.

This, which is the smallest British sandpiper, with one exception (Temminck's Tringa), is the *Tringa minuta* of Leisler according to Temminck and Gould, and the *Tringa pusilla* of Linnæus, Latham, and Pennant, according to the reference to the last-named zoologist by Mr. Yarrell, who considers it to be the *Stint* of Bewick, the *Tringa minuta* of Fleming, the *Minute Tringa* of Selby, and the *Little Stint* of Jenyns.

It is the *Pigmy Sandpiper* of Richardson; the *Bécasseau Echasses* of Temminck; *Gambecchio* and *Culetto* of the Italians; *Der Hochbeinige Strandlaufer* and *Der Kleine Schlummlaufer* and *Zwerg Schlammlaufer* of the Germans; *Stint of Zeeleeurik* of the Netherlanders; and *Y Pibydd lleiaf* of the antient British.

Geographical Distribution.—Dr. Richardson states that this species was seen abundantly in the autumn, feeding, during the recess of the tide, on the extensive flats at the mouth of Nelson's and Hayes rivers: he gives a description of a specimen from Hudson's Bay, now in the British Museum. Tangiers. South Africa. Trebizond. The vicinity of the Caucasus. India. Pennant had noted it as common to North America and Europe, and Latham in a note adds that a variety of it is seen in Indian drawings. All doubt as to the identity of the Indian bird (Bengal) with the British species is now ended by the united testimony of Major Franklin, Mr. Selby, and M. Temminck, the last-mentioned of whom states that it occurs, on its passage, on the banks of the German and French rivers; often in the great marshes of Holland, but rarely on the sea-coasts, and very commonly on the shores of the Lake of Geneva. He adds that it is very numerous in the salt-marshes of Dalmatia, where it is seen in August and September in its winter dress, in which state of plumage the Indian specimens always are. In France the bird is generally seen, on its passage, in the full nuptial plumage. In the British Islands they have been noticed in the vicinity of the Solway, in the west of Lancashire; and on the coasts of Suffolk, Norfolk, Yorkshire, and Durham in the autumn. Mr. Yarrell, who gives these localities, states that the Rev. W. S. Hore and his friend Mr. Gutch saw from forty to fifty of them on the Laira mud-banks near Plymouth October, 1840, and shot ten or twelve of them. Mr. Plomley informed Mr. Yarrell that a flock of thirty was seen Romney Marsh in October, 1839, and the last-name zoologist mentions that they are frequently observed the sands of the coast of Sussex; and that he has obtained them in the London market once in the summer plumage, once in that peculiar to the winter, but more frequently autumn, at which season a small number are seen every year in Belfast Bay according to Mr. W. Thompson.

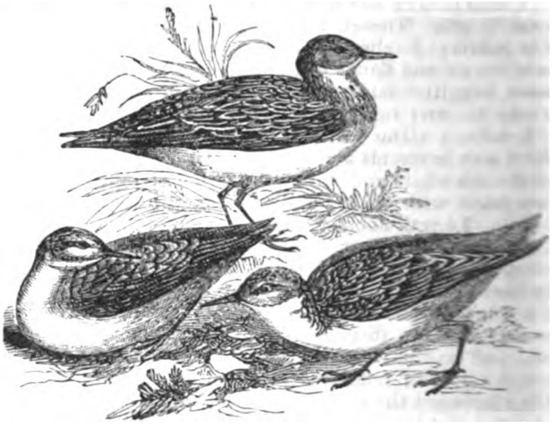
Habits, Nest, Food, &c.—This species haunts sand shores, the banks of large rivers and salt-marshes. In this country it is mostly found in company with the Dunlin and Sanderling on the sandy sea-shore. No one seems know anything of its nesting; but Mr. Gould describes eggs as resembling those of the common sandpiper colour and markings, though they are much smaller. Th food of the species consists of very small worms, river marsh insects, small crustaceans and little mollusks.

The flesh of the Little Stint much resembles that of congeners, but it must not be confounded with the *Stint* the old feasts, which appears to have been the Dunlin Purre.

At the 'intronazation' of Archbishop Nevell, temp. E IV., 'Styntes' are mentioned in the particulars of courses. In the second course of the marriage-feast Roger Rockley and Elizabeth Nevile, daughter of Sir John Nevile, of Chete, Knt., in January, temp. Henry VIII., find 'Item, Stints, 8 of a dish,' and in the accounts of expense in the week for flesh and fish for the same marriage is the 'Item, in Stints, 5 doz. .... 9s.' In the 'Northumberland Household-Book' it appears that Styntes were among the delicacies for the principal feasts or his lordship's own 'mees,' and they are charged in the accounts at sixpence a dozen.

Drayton thus celebrates it in the 'five-and-twentie song' of his *Polyolbion*:—

> 'The Puet, Godwit, *Stint*, the pallat that allure
> The miser and doe make a wasteful epicure'



Little Sandpiper.

Lower figure to the left, winter plumage; upper figure, summer plumage; lower figure to the right, young of the year. (Gould.)

FOSSIL SANDPIPERS.

Dr. Buckland figures a *Tringa* in the first plate illustrating his *Bridgewater Treatise*, among the fossil birds the first tertiary period.

TRINIDAD, an island belonging to England, in the Columbian archipelago, between 10° 5′ and 10° 50′ N. lat and 61° and 62° W. long. It is separated from South America by the Gulf of Paria, which forms an immense harbour with good anchorage. The southern entrance called the Serpent's Mouth, is about ten miles wide, an the northern, or the Dragon's Mouth, is fifteen, but divided into four straits by three islands. The length the gulf is about one hundred miles, with an average width of about forty miles. Trinidad forms an irregular square. Its length from north to south is fifty miles, an its breadth in the central part about thirty miles. The irregularity of its shape is caused by two promontories which form the northern and southern extremities of the island on the western side. The island is, as nearly a possible, the size of Norfolk, and comprises an area of square miles. The western coast is low, and either sandy or swampy, but the three other sides are rocky and elevated. A chain of mountains, which occupies a breadth of about ten miles, and whose highest points vary from 1800 to 2400 feet, runs along the northern side of the island, close to the sea. On the south, parallel to this chain, are extensive plains, intersected by two considerable rivers, which have numerous tributaries, and are navigable. As one of these rivers flows to the east and the other to the west coast, a project has been formed for uniting them by a canal, by which a safe line of internal navigation would be effected between the eastern and western coasts. South of the above-mentioned plains is a range of hills, from 600 to 1000 feet high, which run across the island from south-east to north-west. Again, on the south, occurs another extensive plain, the surface of which is a good deal broken, though it comprises considerable tracts of level country; and between this and the coast there is a chain of hills, none of which attain an elevation of a thousand feet. At the western extremity of the southern promontory there are volcanoes which throw up mud. South of Point Brea the sea in one spot throws up bitumen. The most remarkable natural feature of Trinidad is the Pitch Lake. It is about a mile and a half in circumference. 'The pitch at the sides of the lake is perfectly hard and cold, but as one walks towards the middle with the shoes off in order to wade through the water, the heat gradually increases, the pitch becomes softer and softer, until at last it is seen boiling up in a liquid state. The air is then strongly impregnated with bitumen and sulphur, and the impression of the feet is left upon the surface of the pitch. During the rainy season it is possible to walk over the whole lake nearly; but in the hot season a great part is not to be approached.' (Sir J. Alexander, in Martin's *Colonies*, vol. ii., p. 235.) Attempts have been made to render the pitch applicable to some useful purpose, but so much oil was required to be mixed with it, as to render the experiment commercially unsuccessful. It has been employed in repairing the roads in that part of the island, for which purpose it answers remarkably well.

Trinidad possesses some excellent harbours; but on the eastern coast there are only two, which are not very good. Chaguaramas, on the southern side of the island, near its western extremity, will admit the largest ships. On the same side, at the eastern extremity, is Guaya-guayara, an excellent harbour, protected by Point Galeota. Puerta d'España, on the western coast, is also a good harbour. Here stands the town called the Port of Spain, the capital of the island. On the northern coast there are three or four harbours. Trinidad is not visited by hurricanes.

Trinidad was discovered by Columbus in 1498, when it contained a numerous aboriginal population. It was first colonised in 1588, by the Spaniards; in 1676 it was taken by the French, but almost immediately restored, and in 1797 it was taken by the British, and has since remained in our possession. So greatly were its resources neglected by the Spanish, that in 1783, when it was a dependency of Caracas, the white population was only 126, and with 2032 aborigines the whole population was 2763. At this period the Council of the Indies issued an order encouraging the immigration of Europeans by securing persons from molestation for debt, from whatever country they came, during five years, and by granting the island some commercial privileges. In six years afterwards the population had increased to 10,422, and when the island came into our possession the number of inhabitants was 18,627. The population in 1805 was 25,246; 32,664 in 1811; and 43,678 in 1834; the number of the whites in the latter year was 3632. In 1812 the number of aborigines was 1804 and in 1834 they had diminished to 762. The number of slaves in 1834 was 20,657, and their owners received a sum of 1,033,992*l*., or rather more than 50*l*. a-head, as compensation when slavery was abolished. The number of free blacks and persons of colour in 1834 was 18,724. Since 1834 there has been a great addition to the population. In consequence of the scarcity of labour, active measures have been adopted and funds provided for defraying the expense of conveying immigrants. In the half-year ending 30th June, 1840, the number of persons introduced at the public expense was 3879, and the supply has since been kept up. The immigrants were chiefly from the neighbouring islands, and free blacks from the United States, with a small number of persons from the United Kingdom. Trinidad does not possess a local legislature. The governor is assisted by an executive council and legislative committee consisting of twelve members, six of whom are members *ex-officio*, and hold offices under the crown, and six are selected from the principal inhabitants, and are removable at pleasure. Local taxes are levied by a municipal body called the Cabildo. The island is divided into 37 counties or districts. Port of Spain, the capital, is one of the finest towns in the West Indies, and contains a population of about 12,000. The houses are built of stone and on a regular plan, and wooden houses are not allowed to be erected.

Before 1783 the commerce of Trinidad was very trifling. A small quantity of cocoa, vanilla, indigo, and cotton was raised for exportation, but only sufficient to employ a small schooner two or three times a-year. In 1787 the first sugar-plantation was established. In 1834 the number of acres planted with the sugar-cane was 28,500; with cocoa 10,958; and with coffee 1298 acres. In 1841 the import of sugar into Great Britain from Trinidad was 13 per cent. of the total quantity imported from the West Indies; of molasses 18 per cent.; and of cocoa 86 per cent. All the usual productions of tropical countries grow luxuriantly. The nutmeg, cinnamon, and clove have been introduced, and succeed remarkably well. The scarcity of labour is at present the only obstacle to the more rapid increase of cultivation. In 1833 there were 1378 square miles, or more than three-fifths of the island unappropriated and unsurveyed, the greater part of the virgin soil being very rich. The mountains are capable of cultivation to their summits, and are covered with fine timber. The sandy savannahs are the only barren spots, and they serve to pasture cattle. It is calculated that not more than one-thirtieth part of the island consists of unproductive land. The imports into the United Kingdom of the principal articles of production in Trinidad were as follows in the ten years preceding 1842:—

Years.	Sugar. cwt.	Molasses. cwt.	Rum. galls.	Coffee. lbs.	Cocoa. lbs.
1832	312,266	92,177	5,556	91,352	415,039
1833	286,303	91,344	225	168,170	1,760,258
1834	339,615	99,494	7,714	160,915	999,816
1835	289,393	84,508	9,586	21,950	160,617
1836	312,141	75,176	7,456	163,539	1,292,595
1837	295,367	92,794	741	114,865	1,461,976
1838	286,247	78,387	3,530	425,341	1,678,913
1839	268,669	82,313	10,668	109,641	629,945
1840	245,778	69,608	20,539	253,183	2,007,494
1841	284,605	78,090	2,297	38,622	2,493,302

The commerce of the island now employs about 40,000 tons of shipping. The exports are chiefly to the United Kingdom, but some part of the rum and molasses are shipped to the United States. Small quantities of ginger, arrow-root, indigo, and cotton are exported. The total value of the imports in 1836 was 469,208*l*., chiefly from the mother-country, the exceptions being fish from British North America and lumber from these colonies and from the United States.

(Edwards's *West Indies*, vol. iv. p. 288; *Geography of America*, in *Library of Useful Knowledge*, p. 18.)

TRINITY (Greek, τριάς; Latin *trinitas*, or *trinunitas*) is a word used by theologians* to describe the divine Being as consisting of three persons united in one God. In this, as in most other points of theology, it is necessary to observe the distinction between the teaching of Scripture, and the metaphysical development of the doctrine by theological writers and its dogmatic statement in ecclesiastical formularies.

1. *The Scriptural View of the Trinity.*—On this part of the subject the difference between those who receive the doctrine and those who reject it of course resolves itself into a number of questions in biblical criticism. Referring to the article UNITARIANS for the opinions of the latter party, we proceed to state the views generally held by the former of the scriptural statements concerning the Trinity.

In the Old Testament this doctrine cannot be said to hold a prominent place. The great doctrine therein taught is the unity of God as opposed to polytheism. This point having been clearly revealed in the books of the Old Testament, and having been practically inculcated in the history of the people of Israel, a further revelation of the nature of God was made by Christianity, namely, that in this one only God were mysteriously united three distinct persons, each of them divine. But yet there are passages of the Old Testament in which this doctrine is generally thought to be obscurely revealed or incidentally implied. For example, the divine Being is described by nouns and pronouns in the *plural* number (*Genes.*, i. 26; iii. 22; xi. 7; *Josh.*, xxiv. 19; *Is.*, vi. 8; &c.): the name of God is mentioned in a triple form (*Numb.*, vi. 24-27; *Is.*, vi. 3; xlviii. 12; *Ps.*, xxxiii. 6): the word Jehovah, which is the peculiar title of the self-existent God, is applied to more than one person in the same passage (*Genes.*, xix. 24; *Exod.*, xvi. 28, 29; xxiv. 1; *Levit.*, x. 8-11; &c.): in other passages a person is mentioned as an 'angel of Jehovah,' to whom the name 'Jehovah' itself is also given (*Gen.*, xvi. 7-13; xviii.; *Exod.*, iii. 2-15; xxiii. 20-25): and lastly, divine titles and attributes are repeatedly ascribed to the promised Messiah (*Micah*, v. 1; *Is.*, ix. 5, 6; *Jerem.*, xxiii. 5, 6; *Ps.*, cx. 1; &c.), and to the Spirit of God (*Gen.*, vi. 3; *Exod.*, xxxi. 3; *Deut.*, xi. 29; xxiv. 2; &c.). The opinions of the later Jews seem to show that they had derived some idea of a Trinity from the Old Testament. [LOGOS.] The whole of this branch of the subject is discussed in Dr. J. P. Smith's *Scripture Testimony to the Messiah*, one of the most learned and most temperate theological works ever published.

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* It is said to have been first used by Theophilus of Antioch, in the second century.

But it is in the New Testament, if in any part of Scripture, that the chief proofs of this doctrine will be found. Here, however, we should search in vain for several of the terms used by theologians to express their notions of the Trinity, such as *persons* (ὑποστάσεις) *same* or *similar in substance* (ὁμούσιος, ὁμοιούσιος), or even the word *Trinity* itself. This circumstance is not, as it has been sometimes represented, an argument against the doctrine, but merely an example of that freedom from dogmatic systems which characterises the theology of the New Testament. [THEOLOGY.]

The scriptural argument for the Trinity may be stated in the following manner:—Besides the many passages of the New Testament in which one supreme being (God) is spoken of, there are many others in which mention is made of the Father, the Son, and the Holy Spirit, or the Spirit of God, whose distinct personality is clear from the manner in which they are spoken of. To these three persons divine attributes are ascribed where they are mentioned together, and also to each of them singly. Hence the scriptural proof of the doctrine of the Trinity is twofold: being derived, first, from passages in which the Father, Son, and Holy Spirit are mentioned together as God; and secondly, from passages which prove each of them to be divine. Of the former class of passages, two of the most remarkable are the baptismal formulary (*Matt.*, xxviii. 19), and the apostolic benediction (2 *Cor.*, xiii. 13), to which may be added a great part of the 14th, 15th, and 16th chapters of John's gospel, and several other passages in the gospels, and also 1 *Cor.*, xii. 3-6; *Titus*, iii. 4-6; 1 *Pet.*, i. 2-3. A striking declaration of the same truth is generally thought to be set forth in the circumstances which attended the baptism of Christ (*Matt.*, iii. 16-17; *Luke*, iii. 21-22; *John*, i. 32-34). The passage in 1 *John*, v. 7-8, is now pronounced to be spurious by the almost universal consent of biblical scholars.

Besides this general assertion of the union of the Father, the Son, and the Holy Ghost, in the Godhead, the following passages are produced to prove separately the personality and the divinity of the Father: *John*, i. 14, 18; v. 17, 18; xvi. 26, &c.; Heb., i. 2-5; *Rom.*, xv. 6; 1 *Cor.*, i. 3; *Ephes.*, iii. 14; and the following, in which 'the Father' is also expressly called 'God:' *John*, vi. 44-46; xx. 17; *Ephes.*, i. 17; 1 *Pet.*, i. 2; *Rev.*, i. 6. In all these passages the word *Father* is used with reference to the relation of the Father to the Son. Those passages in which God is called *the Father*, in reference to created beings, are scarcely in point here.

The personality and Godhead of the Son are proved by the assertions of Christ respecting his own nature, whether he is speaking of himself directly, or under the names of 'Son of God' and 'Son of Man,' and by the similar statements of the sacred writers. Thus his person is described as consisting of two parts, the one human, and the other superhuman (*John*, iii. 11, 13; vi. and viii. passim; and compare *John*, i. 15, 30; iii. 31, &c.; 1 *Cor.*, xv. 47-49; *Rom.*, i. 3; ix. 5; 1 *Tim.*, iii. 16; *Heb.*, ii. 17). He is declared to possess an eternal existence, (*John*, i. 1-3; xvii. 5, 24; 1 *John*, i. 2, 5, 20: *Heb.*, i. 10-12; *Rev.*, xxii. 13). To him are ascribed the divine attributes of *Omnipotence* (*John*, v. 19; x. 18; xiv. 13; *Matt.*, xi. 27; xxviii. 18; *Luke*, xxi. 15; *Rom.*, xv. 18; 2 *Cor.*, xii. 9; *Phil.*, iii. 21; 1 *Pet.*, iii. 22; 2 *Pet.*, i. 3), and *Omniscience* (*Matt.*, xi. 27; *John*, vi. 46; xiv. 13, 14; *Acts*, i. 24; 1 *Cor.*, iv. 5). His nature is expressly said to be divine, equal to, and one with God (*John*, v. 18, 23; x. 28; *Phil.*, ii. 6; *Col.*, ii. 9). In his person God is declared to be clearly seen (*John*, xiv. 9), so that he is called the 'image' (εἰκὼν) of God (*Col.*, i. 15; 2 *Cor.*, iv. 4), the 'splendour of his glory, and the exact counterpart of his person' (*Heb.*, i. 3, ἀπαύγασμα τῆς δόξης καὶ χαρακτὴρ τῆς ὑποστάσεως αὐτοῦ). Works are ascribed to him which can only be performed by a divine being: such as the creating, upholding, and governing of the world (*John*, i. 3, 10; *Col.*, i. 16, &c.; 1 *Cor.*, viii. 6; *Heb.*, i. 2, 3, 10; *Matt.*, xi. 27, 28; xviii. 20; *Mark*, xvi. 19; *John*, xvii. 2), the resurrection of the dead, and the last judgment (*John*, v. 21, &c.; *Matt.*, vii. 22, &c.; x. 32; xxv. 31, &c.; *Phil.*, iii. 20). Titles are given and worship paid to him, such as belong to God alone (1 *Cor.*, ii. 8; *Rom.*, xiv. 9; *Phil.*, ii. 10; 1 *Pet.*, iii. 22; *Rev.*, xvii. 14; xix. 16; *John*, v. 23; *Matt.*, xxviii. 19; *Phil.*, ii. 10; *Heb.*, i. 6; *Rev.*, v. 13; *Acts*, i. 24; vii. 59; *Rom.*, ix. 1; x. 12; 1 *Cor.*, i. 2; 2 *Cor.*, xii. 8; *Heb.*, iv. 16; *Rev.*, v. 8-14; vii. 12). His nature is as unsearchable to man as that of the Father (*Matt.*, xi. 27; *Luke*, x. 22; *John*, x. 15). Lastly, he is expressly called *God* (*John*, i. 1; xx. 28; *Rom.*, ix. 5; *Tit.*, ii. 13; *Luke*, i. 16, 17; *Acts*, xx. 28; 1 *Tim.*, iii. 16; *Heb.*, i. 8; *Rev.*, i. 8; xxii. 6).

The argument for the personality and divinity of the Holy Spirit is of a similar character, and rests chiefly on the following passages:—*Rom.*, viii. 26, &c.; *Ephes.*, iv. 30; 1 *Cor.*, xii. 8, &c.; 1 *Pet.*, i. 10, &c.; 2 *Pet.*, i. 21; *John*, iii. 3; *Rom.*, viii. 14; 1 *Cor.*, ii. 12; iii. 16; vi. 11, 19; 2 *Cor.*, i. 22; *Ephes.*, i. 13, &c.; iv. 6, 30; *Gal.*, iii. 14, 26; v. 18, 22; 2 *Tim.*, i. 7; *Acts*, xx. 28; 1 *Pet.*, i. 12; 1 *Cor.*, ii. 10; *John*, xvi. 7-13; *Acts*, v. 3, 4; 1 *Cor.*, vi. 19; 2 *Cor.*, vi. 16.

Though the Scriptures furnish us with no systematic account of the relations which the three persons of the Trinity respectively sustain to each other and to created beings, yet they contain statements and illustrations which must form the basis of every attempt to explain this most difficult subject. Thus, besides the relations implied in the names *Father*, *Son*, or *Word* [LOGOS], *Spirit of God*, or *Holy Spirit*, we are expressly informed respecting the *Father*, that he is the source of all being and life (1 *Cor.*, viii. 6); that he is invisible and incomprehensible, except as revealed by and through the Son (*John*, i. 18; vi. 46; comp. 1 *John*, iv. 12; 1 *Tim.*, vi. 16); that his very essence is love, and that his love is manifested to men in the incarnation of the Son (*John*, iii. 16-17; 1 *John*, iv. 8, 16). Every visible and sensible revelation of the Godhead to created beings has been made from all eternity *through the Son*, who is called the *first* and *only begotten*, the *Son of the Father's love*, and in whom the whole fullness of the Godhead is said to be contained (*Col.*, i. 13; *John*, iii. 16; x. 36; *Rom.*, viii. 32; *Ephes.*, i. 6; *Mark*, xii. 6; xiv. 61; 1 *John*, iv. 15; v. 9-12; *Col.*, ii. 9; and several other passages). The *Holy Spirit* is said to be sent forth by or to proceed from the Father and the Son, and to honour the Son and reveal him to men (*John*, xvi; 1 *Cor.*, xii. 3; and other passages).

There is one illustration of the subject in Scripture which many theologians regard as furnishing the nearest possible step to a clear apprehension of the whole subject. Since the Son is called the *light* of the world, and the Holy Spirit is said to give *warmth* and *life*, it has been thought that the Divine Being may be compared to that element on which the whole existence of the physical universe seems to depend, which, while in itself incomprehensible and invisible (like the *Father* in the Godhead), is made manifest to the senses by the light and heat which it gives out, as the deity is revealed by the Son and Spirit. This illustration is carried out, and its value as an illustration is discussed by Hahn (*Christ. Glaubenslehre*, th. i., § 55).

The fact deserves especial notice, that in the biblical statement of this doctrine no attempt is made to reveal to us what constitutes the *substance* or *essence* of the Divine

Being, or what is the *mode* in which three distinct persons are united in that substance. But little reflection is necessary to see the reason of this: we could not have understood such an explanation had it been made, even if human language could have furnished the means of expressing it, which is more than doubtful. Controversial writers upon this doctrine seem often most strangely to have forgotten that *all our knowledge*, whether of spiritual or material existences, is a knowledge of attributes and properties, not of essences. The essential nature of the Divine Being is not at all more mysterious to us than the essential nature of matter or of our minds, or of those principles which are manifested to us in the phenomena of life, motion, heat, light, attraction, and repulsion, since all these things are equally beyond the reach of human knowledge. In fact, while the Scripture holds forth most clearly the truth that the nature of God is entirely different from that of man, it yet teaches us all that it reveals respecting the actions and feelings of God by speaking of him as if he were a man (*anthropomorphism*). This is simply a matter of necessity in the present state of men and their language. Therefore to expect of theologians that they should be able to give a perfectly intelligible account of the mode of the divine existence, or the nature of the divine substance, is a requirement the absurdity of which can only be exceeded by the folly of attempting to comply with it. Hence the error of those who at once deny the doctrine of the Trinity on the preliminary objection that it is incomprehensible. Such persons have to show, not only that it involves a paradox, but that it involves a necessary contradiction, which the very nature of the case forbids them to prove. [PARADOX.] The doctrine, as stated in Scripture, is not equivalent to the assertion that there is a being of which the whole is equal to each of three parts into which it is divided: such a statement would of course be self-contradictory if applied to physical existences, but as applied to the divine essence it is simply unmeaning. The scriptural statement is that in the one undivided and uncompounded substance of God there are united three distinct divine persons, who are revealed as such by their several operations, and each of whom possesses the same perfection of divine attributes which is possessed by the whole Godhead. This proposition is undoubtedly mysterious, but it cannot be proved to be self-contradictory until we have first learnt what the *nature of the divine essence* really is.

The only proper ground on which to rest the discussion is therefore the question whether the Scripture really teaches at the same time the Unity and the Trinity of the Godhead. If Christians had confined their attention to this point, there can be no doubt that the greater number of their divisions respecting the subject would never have arisen.

II. *The History of the Doctrine of the Trinity.*

The earliest controversies on this subject (such as those with the Ebionites and Docetæ) related to the person of Christ, rather than to the doctrine of the Trinity as a whole, and they retained this character down to the time of the Council of Nice, as is strikingly shown by the absence from the Nicene Creed of any statement in reference to the Holy Spirit. In that creed, with the addition made to it by the Council of Constantinople respecting the Holy Spirit, we find the first dogmatic statement of the doctrine of the Trinity. [NICENE CREED.] The deviations from this standard in the early church were in three directions: either, by a confusion between the terms *substance* and *person*, the distinct personality of the Father, Son, and Spirit was stated in such a way as to contradict the unity of their substance, and to make it appear that there are three Gods instead of one, which is called *Tritheism;* or the Father was regarded as the only supreme God, and as superior to the other persons of the Trinity, which is the doctrine called *Subordinationism*, and was held with various modifications by the different bodies of ARIANS; or, lastly, the triplicity of persons in the Godhead was rejected altogether, and the Son and Spirit were held to be the same person as the Father, revealed under different aspects, or, in other words, the terms *Father*, *Son*, and *Spirit* were explained as signifying not persons, but only different *modes* of the divine existence: this last is the tenet of the SABELLIANS. For the subdivisions of these opinions see, in addition to the articles referred to, HERESY AND HERETICS. Perhaps Tritheism ought hardly to be regarded as a real opinion, but rather as one which has been erroneously ascribed to some writers on account of their unguarded statements. Of the other two systems, both are attempts to escape from the difficulty of the doctrine: the one, namely, Arianism, by denying the proper divinity of the Son and the Spirit; the other, namely, Sabellianism, by denying their distinct personality. The discussion of these systems gradually led to the formation of a new dogmatic statement of the views of the Church respecting the Trinity, in the celebrated Creed incorrectly termed Athanasian, in which the doctrine of the Nicene Creed is more minutely stated, and an attempt is made to explain more clearly the relations of the Father, Son, and Spirit, to each other, and to the Trinity as a whole. [ATHANASIAN CREED.] This creed and the Nicene form to the present day the generally-received symbols of the orthodox faith respecting the Trinity.

In the seventh century a difference arose between the Greek and Latin churches on the following point:—The Latin church had received the Nicene Creed, and had added to it a declaration respecting the Holy Spirit, which agreed for the most part with the Constantinopolitan addition to the same creed. But while the latter represented the Spirit as 'proceeding' only 'from the Father' (τὸ ἐκ τοῦ πατρός ἐκπορευόμενον), the Latins held that the Spirit proceeded 'both from the Father and the Son' (a patre filioque), and the addition 'filioque' was confirmed by the council of Toledo, in Spain, in the year 589. After several fruitless attempts to accommodate the difference, the result was, that at the separation between the Greek and Latin churches, in 1054, each retained its own form of the clause. [GREEK CHURCH.] Between this period and the Reformation there is little worthy of notice in the history of the doctrine. As the Nicene Creed had refined upon the Bible, and the Athanasian on the Nicene, so the schoolmen refined on the Athanasian Creed, not without serious consequences to themselves. Abailard was compelled by the synod of Soissons (1122) to burn his book 'De Trinitate' with his own hands, on account of its alleged Sabellianism, and several other schoolmen were condemned for Sabellianism or Tritheism.

At the Reformation the Protestants in general retained the doctrine of the Trinity as set forth in the Athanasian Creed. About the same time the rise of Socinianism gave a new form and strength to Anti-Trinitarian opinions.

Other religions present traces of a doctrine somewhat resembling the Trinity; as, for example, in the Trimurti of the Indians (Bramah, Vishnu, and Shiva), the Triad of the Egyptians (Kneph, Neith, and Phtha), and the Scandinavian triad of Odin, Braga, and Freia. All these triads however seem to have reference to a supposed threefold form of the powers of nature, while the Christian doctrine of the Trinity rests entirely upon an historical basis, namely, the testimony of Scripture.

Most of the writers on the Trinity worth consulting are referred to in the works mentioned in the following list:—Doddridge's *Theological Lectures*, in Kippis's edition of his works; Watson's *Theological Institutes;* Dr. J. P. Smith's *Scripture Testimony to the Messiah;* Wardlaw's *Discourses on the Socinian Controversy;* Yates's *Vindication of Unitarianism;* the *Church Histories* of Mosheim and Neander; Hahn's *Lehrbuch des Christlichen Glaubens;* Hagenbach, in Ersch and Grüber's *Encyklopädie*, art. 'Dreieinigkeit.'

TRINITY COLLEGE, CAMBRIDGE. Two colleges formerly existed upon the site of Trinity College: the one named Michael House, dedicated to Michael the archangel, was founded in 1324, by Harvey de Stanton, chancellor of the exchequer to King Edward II.; the other was King's Hall, founded in 1337 by King Edward III. Both were resigned into the king's hands in 1546 by the respective masters, and their lands in the same year made part of the endowment of a new college founded by King Henry VIII., under the name of Trinity College. The king appointed his college to consist of a master and sixty fellows. Queen Mary added to the endowment the rectories of Eversham, Kendal, and Kirkby Lonsdale in Westmoreland, and of Sedburgh and Aysgarth in Yorkshire, then producing a revenue of about 350*l.* per annum, for the maintenance of twenty scholars, ten choristers and their master, four chaplains, thirteen poor scholars, and two sizars. Several other scholarships have been added; the present number is sixty-nine.

The government of the college is vested in the master and the eight senior fellows; and to such of the senior fellows as are absent, the resident fellows next in order of seniority are considered as deputies. The Fellows are chosen from the scholars, who are ineligible if they are M.A., or of sufficient standing to take that degree. All are required to go into priest's orders within seven years after they commence Masters of Arts except two, who are appointed by the master, and permitted to remain laymen. The one is supposed to study law, the other physic. Any person who is a British subject is eligible to a fellowship in this college; and all the fellowships are open without any exception. The scholarships are also open, but two or three are usually filled up annually by scholars chosen from Westminster School; and one of 50*l.* per annum, founded by Mr. Newman, is to be given to a native of Kent or Cambridgeshire alternately.

The exhibitions of this college are as follow:—four, Dr. Lewis, 8*l.* 6*s.* per annum each to four scholars, natives of North Wales: one, Mr. Elwes, 6*l.* for a scholar appointed by the master; five, Mr. Perry, 13*l.* per annum each, to scholars from St. Paul's School, London; three, Mr. Jeston, 6*l.* 13*s.* 4*d.* each, for poor scholars; one, Mr. Hope, 3*l.* 8*s.* 8*d.*, for scholars from Lynn School; two, Lady Verney (estate at South Littleton), for scholars from Cranbrook or Warwick school.

Lady Campden founded several exhibitions from St. Paul's School to Trinity College, some of which are 100*l.* per annum, and others of 70*l.* per annum; they are selected by examination from the foundation scholars of St. Paul's School.

Various benefactions to the amount of 136*l.* are consolidated and divided among the resident sizars; to whom also all noblemen pay two guineas and fellow-commoners one guinea each per quarter. There are also sixteen sizars upon the foundation, who are entitled to commons, rooms, and the principal part of the emoluments; to these the subsizars succeed in the order of their places in the classes at the annual examinations.

Numerous annual prizes are distributed in this college, chiefly for literary compositions.

There are sixty-five pieces of ecclesiastical preferment in the gift of Trinity College, rectories, vicarages, and perpetual curacies; eight of which are in Bedfordshire, two in Buckinghamshire, eleven in Cambridgeshire, one in Durham, two in Essex, four in Hertfordshire, one in Leicestershire, three in Lincolnshire, one in Middlesex, six in Nottinghamshire, four in Norfolk, one in Northumberland, one in Staffordshire, one in Suffolk, one in Warwickshire, three in Westmoreland, one in the Isle of Wight, and thirteen in Yorkshire. Three of the advowsons now vested in Trinity College belonged to Michael House, and five to King's Hall.

Among the many eminent persons who have been educated at Trinity College are Robert Devereux earl of Essex, Sir Robert Cotton, Sir Henry Spelman, Lord Chancellor Bacon, Sir Edward Coke, Dr. Donne, John Ray, Francis Willoughby, Dr. Isaac Barrow, Sir Isaac Newton, Roger Cotes, Abraham Cowley, John Dryden, Andrew Marvel, and Dr. Conyers Middleton. Among the more eminent Masters of this college have been Archbishop Whitgift, Bishop Wilkins, Bishop Pearson, Dr. Isaac Barrow, and Dr. Richard Bentley.

Trinity College is situated between St. John's and Caius College, occupying the space between Trumpington Street and the river Cam. It consists of two large courts of unequal dimensions: the larger court is about 630 yards in circuit; the west side, which is the longest, is about 174 yards; the east side about 163 yards, the north 145, and the south about 141. This court is entered from Trumpington Street by a turretted gateway, said to have been formerly the entrance to King's Hall. The inner court is called Neville's, from Thomas Neville, master of the college and dean of Canterbury, by whose benefaction the principal part of it was built. The library, which now forms the west side, is of later date, and was designed by Sir Christopher Wren; it is the only part of the College that has any architectural pretensions. A third court, adjoining Neville's court, was completed in 1825. There is now accommodation within the college walls for about 230 persons.

The chapel, which was begun by Queen Mary, and finished by Queen Elizabeth, is above 200 feet in length. In the ante-chapel is a statue of Sir Isaac Newton, by Roubiliac, presented to the Society by Dr. Smith, who succeeded Dr. Bentley as master; and a bust of Porson, by Chantrey.

The hall, which is about 100 feet in length, is in the mixed style of architecture which began in the reign of Henry VIII.

The master's lodge, which contains several spacious apartments, has always, since the time of Queen Elizabeth (who was herself lodged in King's College), been the residence of the king when the university has been honoured with a royal visit; and the judges always lodge there during the assizes. The sash-windows which disfigured this part of the court have just been taken out, and the lodge has been restored so as to make it harmonize with the general appearance of the great court.

The master is appointed by the crown, and the king is visitor of the College, excepting with respect to the master who is visited by the bishop of Ely.

The copy of the statutes in the Trinity library, which the library-keeper believes to be the earliest *printed*, bears the date MDCCLXXIII. The statutes are printed in the 'Second Report from the Committee on the Education of the Lower Orders,' 1818, vol. iv., pp. 363-403, from MS. Donat. Brit. Mus. 659.

The number of members on the boards, March 12, 1842, was 1797.

(Lysons's *Magna Brit.*, Cambr., pp. 125-128; Cole's *MS. Volume*, Brit. Mus., xlv., pp. 219-363; *Cambr. Univ. Calendar*, 1842.)

TRINITY COLLEGE, OXFORD. This college was originally founded and endowed by Edward III., Richard II., and the priors and bishops of Durham. As it was under the patronage of the bishops of Durham, it obtained the name of Durham College, though dedicated from the beginning to the Holy Trinity, St. Mary, and St. Cuthbert. At the Reformation it was suppressed. Sir Thomas Pope, Knt., of Tittenhanger in Hertfordshire, 20th February, 1554-5, purchased the site and buildings of Dr. George Owen and William Martyn, to whom a grant of them had been made a short time before from the crown, and he founded the present college, dedicated to the 'Holy and undivided Trinity,' for a president, twelve fellows, and twelve scholars.

The founder directs that the scholars shall be chosen from his manors; but if no such candidates properly qualified appear on the day of election (Trinity Monday), that then they shall be supplied from any county in England; not more than two natives of the same county can be fellows at the same time, except Oxfordshire, of which county five are allowed.

There is also a scholarship, nearly coeval with Sir Thomas Pope's foundation, founded by Richard Blount, Esq., of the city of London, who was connected by marriage with the founder; an exhibition called the Unton Pension, given by Thomas Unton, clerk, of Drayton in Shropshire, in 1693; a second, called the Tylney exhibition, granted by Frederic Tylney, Esq., of Hants, in the year 1720; and a third, by the Rev. Edward Cobden, D.D., archdeacon of London, who, by will dated April, 1784, bequeathed the sum of 400*l.* to a certain fund of Winchester College, called the Superannuate-fund, to the intent that the interest thereof might be applied to found an exhibition in Trinity College, Oxford, for the advantage of the superannuate scholars of Winchester College aforesaid. This exhibition has been augmented from time to time by the liberality of the warden and fellows of Winchester College.

The benefices in the patronage of this college consist of the rectory of Farnham, and the vicarages of Navestock and Waltham Magna, in Essex; the rectories of Garsington, Oddington, and Rotherfield Grays, in Oxfordshire; the donative of Hill-Farrance in Somersetshire; and the rectory of Barton-on-the-Heath in Warwickshire; with the lectureship of St. Nicholas Abingdon, in Berks.

Among the more eminent persons educated in this college are,—Sir James Harrington, the author of the 'Oceana;' John Selden; John Evelyn; Archbishop Sheldon; Chillingworth; Derham, the author of the 'Physico-Theology;' the first Earl of Chatham; Lord North; and Thomas Warton, the author of the 'History of English Poetry.'

The original buildings of this college were those which belonged to Durham College, and were repaired by Sir Thomas Pope for the use of his society. They consisted principally of a low quadrangle, with the hall, library, and chapel. About the beginning of the seventeenth century Dr. Kettel, then president, added garrets to part of the quadrangle, and erected some buildings near the kitchen, at the north end of the hall. During the great rebellion however the buildings became ruinous; and in 1664 Dr. Bathurst, then president, began his extensive designs with repairing his lodgings on the east side of the quadrangle, which he afterwards completed in 1687, at his own expense. Soon after a new court of three sides was projected in the Fellows' garden, the north side of which was finished in 1667. The west side was not completed till 1682; nor the south till 1728. Sir Christopher Wren was the architect employed on this court. The hall, on the west side of the first quadrangle, originally that belonging to Durham College, having fallen into decay, was rebuilt in 1618. The library, though it has undergone various changes, is in substance the oldest part of the college, having been erected in 1370. The present edifice of the chapel, originally that of Durham College, was erected between 1691 and 1694.

The bishop of Winchester is the visitor of this college.

The number of members on the books, December 31, 1841, was 296.

(Chalmers's *History of the Colleges and Halls of Oxford*, vol. ii., p. 341-367; Ingram's *Memorials of Oxford*, vol. ii.; *Oxford Univ. Calendar for* 1842, p. 310-315.)

TRINITY HALL, CAMBRIDGE, was founded in 1350, by William Bateman, bishop of Norwich. It is now more peculiarly appropriated to the study of civil law, and has twelve fellowships open to persons of every nation and country without restriction.

Bishop Bateman, the founder and noble benefactor of this institution, originally intended to found twenty fellowships, but dying before the foundation was completed (A.D. 1355, at Avignon), his gift was only sufficient for the maintenance of a master, three fellows, and two scholars. The nine remaining fellowships were founded by the following benefactors: two by Simon Dalling; three by Bishop Nix; one by Robert Goodnape; one by Dr. Hawke; one by Dr. Mowse; and one by the college. It is usual that ten of the fellows should be laymen and two in holy orders. Graduates in Arts, not of less standing than within one year of the time of incepting as M.A., and students of three years' standing in civil law, are eligible.

There are also fifteen scholarships belonging to this hall, namely: three of the first class, of fifty guineas a year each; three of the second class, of thirty guineas; and nine of the third class, of twelve. These scholarships are awarded, according to merit, to undergraduates who distinguish themselves at the college examinations in the Lent and Midsummer Terms of their first year, and are tenable during residence.

There is likewise a provision, worth about 30*l*. a year, for a chapel-clerk, who is usually selected from the more distinguished of the scholars.

The benefices in the gift of Trinity Hall consist of the curacy of St. Edward, in Cambridge; the vicarage of Wethersfield, in Essex; the vicarages of Fenstanton-cum-Hilton, Hemingford Grey, and Great Stukeley, in Huntingdonshire; the rectory of Swannington and vicarage of Woodalling, in Norfolk; and the curacy of Cowling, with the rectory of Kentford and vicarage of Gazeley, in Suffolk.

Among eminent persons who have been members of this society are Stephen Gardiner, bishop of Winchester; Samuel Horsley, bishop of St. Asaph; and Philip Dormer, earl of Chesterfield.

This college, which is situated near the river, between Clare Hall and Gerrard-hostel Lane, consists of a small neat court faced with stone. The old hall was demolished in 1742.

The number of members on the boards of this hall, March 12, 1842, was 143.

A Copy of the statutes of this foundation is preserved in the Harleian MS. 7029, p. 385.

(Lysons's *Magna Britannia*, Camb., pp. 108, 109; *Camb. Univ. Calendar*, 1842; Cole's *MS. Collections*, Brit. Mus., vol. vi., p. 84, et seq.)

TRINITY HOUSE OF DEPTFORD STROND, THE CORPORATION OF—its full title is, 'The Master, Wardens, and Assistants of the Guild, Fraternity, or Brotherhood of the Most Glorious and Undivided Trinity, and of Saint Clement, in the parish of Deptford Strond, in the county of Kent'—an institution to whose members is intrusted the management of some of the most important interests of the seamen and shipping of England. Its duties and powers will best appear by a review of its history, and of the royal charters, grants, and several statutes under which the same exist. The earlier records, together with the house of the corporation, were destroyed by fire in 1714, so that the origin of the institution can only now be inferred from usage and the occasional mention of its purposes in documents of a later period. It seems however certain that the increase of shipping and the use of vessels of great burden having augmented the importance of a correct knowledge of the intricacies of the navigation of the channels leading into the river Thames and of the river itself, an association of seamen was formed for the purpose of forwarding and assisting the attainment of that object. It was material also that this knowledge should be solely possessed by British subjects; and probably this was present to the mind of Henry VII., who, when earl of Richmond, with a very inferior fleet, had crossed the English Channel from Harfleur, and effected a landing at Milford Haven, without molestation. That king bestowed great care upon the improvement of the navy, and it is presumed that with him originated the scheme, afterwards carried into effect by his son Henry VIII., of forming efficient navy and admiralty boards, which then first became a separate branch of public service. During the reign of Henry VIII. the arsenals at Woolwich and Deptford were founded; and we learn from Stowe that the Deptford-yard establishment was subsequently placed under the direction of the Trinity House, who likewise surveyed the navy provisions and stores. The earliest official document now extant is a charter of incorporation made by Henry VIII. in the 6th year of his reign. The first master acting under it was Sir Thomas Spert, commander of the famous ship called Henry Grace-à-Dieu, built by Henry VII. An exemplification of this charter was granted by George II. in the third year of his reign. In it Henry says, 'We, on account of the sincere and entire love and likewise devotion which we bear and have towards the most glorious and undividable Trinity, and also to Saint Clement the Confessor, have granted and given license, for us and our heirs, as much as in us is, to our beloved liege people and subjects, the shipmen or mariners of this our realm of England, that they or their heirs, to the praise and honour of the said most glorious and undividable Trinity and Saint Clement, may of *new begin*, erect, create, ordain, found, unite, and establish a certain guild or perpetual fraternity of themselves and other persons, as well men as women, in the parish church of Deptford Strond, in our county of Kent.' The brethren are by the same charter empowered from time to time to elect one master, four wardens, and eight assistants, to govern and oversee the guild, and have the custody of the lands and possessions thereof, and have authority to admit natural-born subjects into the fraternity, and to communicate and conclude amongst themselves and with others upon the government of the guild and all articles concerning the science or art of mariners, and make laws, &c. for the increase and relief of the shipping, and punish those offending against such laws; collect penalties, arrest or distrain the persons or ships of offenders, according to the laws and customs of England or of the Court of Admiralty. The charter also grants to the corporation all liberties, franchises, and privileges which their predecessors the shipmen or mariners of England ever enjoyed.

It is supposed that prior to the incorporation by Henry VIII. there was a station belonging to the association of seamen near the entrance of the river, for the purpose of supplying pilots to vessels inwards, as well as one at Deptford or London for the supply to vessels outwards.

On arriving at the reign of Queen Elizabeth it is impossible not to be struck by the wisdom and foresight of the measures taken by that queen through the agency of the Trinity House for the purpose of forwarding the interests of the sea service, measures the more to be regarded when brought into contrast with those of some of her successors. In the first year of her reign she recognised all the rights and immunities of the corporation (reciting in a charter confirming the same certain grants from King Edward VI. and Queen Mary); and in the 8th year of her reign an act was passed enabling the corporation to preserve antient sea-marks, to erect beacons, marks, and signs for the sea, and to grant licences to mariners during the intervals of their engagements to ply for hire as watermen on the river Thames. This act describes the members of the corporation as 'a company of the chiefest and most expert masters and governors of ships incorporate within themselves, charged with the conduction of the queen's majesty's navy royal, and bound to foresee the good increase and maintenance of ships and of all kind of men traded and brought up by watercraft most meet for her majesty's marine service;' and after reciting the destruction of steeples, woods, and other marks on the coasts, whereby divers ships had been lost, to the great detriment and hurt of the common weal and the perishing of no small number of people, prohibits the destruction of any existing marks after notice, under a penalty of 100*l.*, a very heavy fine in those days. An important question arose in the reign of James I., whether the words of the act of the 8th Elizabeth included *lighthouses*, which it would seem had not been introduced in England at the time it was passed: it appears to have been held by the two chief justices, 1 James I., that they did (4 *Inst.*, 149). Nevertheless, in 1616, Sir William Erskine and Sir John Meldrum having applied for a patent to crect lights at Winterton, the corporation of Trinity House petitioned against it on the ground that they alone were entitled to make such erections, and the privy council decided in their favour. The king however was prevailed on to refer the matter to Sir Francis Bacon, then attorney-general, who reported his most able opinion in these striking words:—'That lighthouses are marks and signs within the meaning of the statute and charter. That there is an authority mixed with a trust settled in that corporation for the erecting of such lighthouses and other marks and signs from time to time as the accidents and moveable nature of the sands and channels doth require, grounded upon the skill and experience which they have in marine service, and this authority and trust cannot be transferred from them by law, but as they only are answerable for the defaults, so they only are trusted with the performance, it being a matter of an high and precious nature, in respect of the salvation of ships and lives, and a kind of starlight in that element.' This was read in council, and on the 26th March, 1617, an order was made reciting it, and 'that their lordships found further cause to be confirmed in their first opinion that the masters of the Trinity House of Deptford Strond ought solely to have the erecting and disposing of all such seamarks and signs, and that no other person ought to intermeddle therein; which their lordships did this day declare in council as the opinion of the board, with a saving still to his majesty's further pleasure. But withal straitly admonished the said masters of the Trinity House upon their duties, that as they were only trusted, and all others excluded, they should be careful to discharge that trust which the state had reposed in them, and that in all places needful they should cause to be speedily and timely set up such lights and other sea-marks and signs as may serve for the safe direction of sea-faring men upon any of his majesty's coasts whatsoever, that the lives, ships, and goods of his majesty's subjects, friends, and allies may not be in danger of perishing through their negligence or want of care.' King James probably disapproved of this decision, because it went to preclude him from exercising that lucrative trade in the sale of monopolies and patents which formed so principal a grievance of his reign. Accordingly very shortly afterwards, Sir Francis Bacon having been made lord keeper, the same point of law was referred to Sir Henry Yelverton, then attorney-general, and such of the king's counsel as he might think proper to call to his assistance.

The result was the following report, more satisfactory perhaps to his majesty, but the cause, in aftertime, of much evil, loss, and expense to the nation, because the management of several lighthouses was in consequence granted to individuals. After stating the circumstances, the Report, which is dated 4th June, 1617, goes on:—

'We herein certify our opinion to your lordships:

'1. That lighthouses are signs and marks within the meaning of the statute aforesaid.

'2. That there is an authority given by the statute to the Trinity House, to erect such lighthouses if they think fit, and a trust reposed in them to do it if they will.

'3. That they of the Trinity House cannot transfer this authority to any other.

'But we are of opinion that the authority given to the Trinity House by the statute 8th of Elizabeth, taketh not away the power and right which was and still is in the Crown by the common law to erect such houses. For that statute is made wholly in the affirmative, that they of the Trinity House shall and may erect such lights and marks at sea, but excludes not his majesty. And we are informed that since the statute, both in the time of his majesty and of the late queen, there have been some lighthouses erected by authority from the crown.

'And therefore, howsoever the ordinary authority and trust for the performance of this service is committed to the said corporation alone, as persons of skill and trust to that purpose, yet if they be not vigilant to perform it in all places necessary, his majesty is not restrained to provide them according to his regal power and justice, for the safety of his subjects' lives, goods, and shipping in all places needful.'

In the 36th year of her reign Queen Elizabeth, but partly it would seem at the praiseworthy instance and by the aid of Lord Howard of Effingham, her high admiral, made a grant to the corporation of the lastage and ballastage of all ships in the river Thames and of the beaconage and buoyage upon the coasts of the realm which had previously afforded a considerable source of revenue to the lord high admiral. The grant recites that he had surrendered into the queen's hands the lastage and ballastage of all ships coming into or being in the Thames, and also the right to erect and place beacons, buoys, marks, and signs for the sea, on it or on the shores, coasts, uplands, or forelands near it, and besought her to grant all powers respecting these matters to them. And it then proceeds to grant the same and all fees relating to them in the fullest manner to the corporation for ever.

James I. soon after his accession granted a charter of confirmation dated 1604. What else he did has already been stated, and by him and his successors various patents for and leases of lighthouses to individuals were at different times granted. Charles II. also granted to the Trinity House a charter of confirmation, but in the 17th year of his reign he granted the right of lastage and ballastage to one Colonel Carlos. This was the more extraordinary, because by the recital in his charter of the grant of Elizabeth he recognized the right to be in the corporation. it was however conferred upon Colonel Carlos on the assurance that it would not injure them, and the colonel was to pay 1000 marks a year for it into the Exchequer. The corporation resisted this grant successfully, and soon after Colonel Carlos surrendered it to the king, who regranted it to the corporation for 31 years (Elizabeth's grant having been 'for ever'), with the addition of all the waste lands bordering on the Thames from Staines Bridge to the Medway. This portion of the grant was however disputed by the City of London, and eventually the king regranted it as it had been granted by Elizabeth, except that the fees and profits were expressly appropriated to the use of poor seamen, their wives, &c., and the 1000 marks were reserved to Colonel Carlos. The grant confirms the exemption of the brethren and their servants, &c., from all service, civil and military, unless by order of the Privy Council. James II., who was much interested in naval matters, granted a fresh charter, the one now in force, in the first year of his reign. It recites the former grant and charter, and declares the body to be a corporation, and that for the future it shall consist of one master, and one deputy master, four wardens, and four deputy wardens, eight assistants, and eight deputy assistants, eighteen elder brethren, and a clerk. The master nominated by the charter was Pepys, then secretary to the admiralty. It determines the mode of election of these officers, their continuance in office, and the mode of removing them from it, if necessary; and declares that all seamen and mariners belonging to the guild shall be younger brethren. It directs the masters and wardens to examine such boys of Christ's Hospital as shall be willing to become seamen, and to apprentice them to commanders of ships. It also enables them to appoint and license all pilots into and out of the Thames, and prohibits under penalties all other persons from exercising that office; it also authorises the corporation to settle rates of pilotage, &c., to hold courts, &c., to punish seamen deserting, &c., and make laws as to their subject-matters not inconsistent with the laws of the kingdom. It also contains many provisions directed to the object of keeping the navigation of the channels secret from foreigners, and renders the officers of the corporation liable to attend when required at the king's bidding. Since that time several acts of parliament have been passed for the purpose of authorising the Trinity House to regulate matters connected with the pilotage, &c. of vessels.

It may not be improper here to commemorate the very important services rendered to the country by the corporation on two occasions during the late wars. At the time of the mutiny at the Nore, in 1797, a member of the corporation suggested to the first lord of the Admiralty the destruction of the beacons and buoys in the river. The suggestion was immediately adopted and a delegation of the brethren was dispatched the same night to carry it into effect. It was accomplished with complete success almost in the view of the mutinous fleet, and every means were removed by which they might have been enabled in safety to make their way out to sea. The memorable declaration of the merchants, bankers, &c., relative to the proceedings on board our fleet, was also in consequence of a suggestion made to the prime minister, at the same time by the same member of the corporation. In 1803, when the invasion from France was momentarily threatened and feared, the shipping in the river and London itself appeared in the greatest peril. The elder brethren, at the suggestion of the then deputy-master, volunteered to undertake the defence of the river. Their offer was accepted, and the corporation exerted all their talent and influence to carry it into effect. A corps of nearly 2000 volunteers was embodied, entitled the 'Royal Trinity-House Volunteer Artillery:' it consisted of members of the corporation and other seafaring people, the then master, Mr. Pitt, being colonel; the deputy-master, Mr. Cotton, lieutenant-colonel; the elder brethren captains, and some of the younger brethren lieutenants. Ten frigates lying in ordinary were placed at their disposal: they were moored in a curved line across the river in the Hope, where they formed, without any practicable interval, a battery of nearly 200 guns. The expense to the corporation on this occasion was at least 12,000*l.*, besides individual subscriptions from the elder brethren and other members of the corps to a large amount.

The various provisions in matters of pilotage under the management of the corporation were repealed by the 6 Geo. IV., c. 125, entitled 'An Act for the amendment of the law respecting pilots and pilotage, and also for the better preservation of floating lights, buoys, and beacons,' which recites the extent of the jurisdiction of the Trinity House in regard to pilots to be, upon the river Thames, through the North Channel, to or by Orfordness, and round the Long Sand Head, or through the Queen's Channel, the South Channel, or other channels into the Downs, and from and by Orfordness and up the North Channel, and up the rivers Thames and Medway, and the several creeks and channels belonging or running into the same; and contains a variety of minute regulations respecting the examination, licensing, and employment of pilots, the rates of pilotage, provisions for decayed pilots, the protection of buoys, &c. At the present time however, besides those under the jurisdiction of the Trinity House and of the lord warden of the Cinque Ports, many independent pilotage establishments exist in various parts of the kingdom, but the expediency of subjecting all these to the sole uniform management of the Trinity House has been felt for some time past, and will probably soon become the subject of parliamentary enactment. The inconvenience and disadvantage resulting from the exercise of similar authorities vested in the hands of different parties had been felt with regard to the lighthouses on the coast, several of which were vested in private hands by the crown; while some had been in times past leased out by the corporation itself, the lights in both instances being found to be conducted probably rather with a view to private interest than public utility. By an act therefore of the 6 & 7 Wm. IV., c. 79, passed 'in order to the attainment of uniformity of system in the management of lighthouses, and the reduction and equalization of the tolls payable in respect thereof,' provision was made for vesting all the lighthouses and lights on the coasts of England in the corporation of Trinity House, and placing those of Scotland and Ireland under their supervision. Under this act all the interest of the crown in the lighthouses possessed by his Majesty was vested in the corporation in consideration of 300,000*l.* allowed to the Commissioners of Crown Land Revenue for the same, and the corporation were empowered to buy up the interests of the various lessees of the crown and of the corporation, as well as to purchase the other lighthouses from the proprietors of them, subject in case of dispute to the assessment of a jury. Under this act purchases have been made by the corporation of the whole of the lighthouses not before possessed by that body, the amount expended for the purpose being little short of a million of money.

The annual revenue of the corporation is very considerable, and is derived from tolls paid in respect of shipping receiving benefit from the lights, beacons, and buoys, and from the ballast supplied. The ballast is raised from such parts of the bed of the river as it is expedient to deepen, by machinery attached to vessels, and worked partly by the power of steam and partly by manual labour. The remainder of the revenue proceeds from lands, stock, &c. held by the Corporation, partly by purchase, partly from legacies, &c., and donations of individuals. The whole is employed upon the necessary expenses of the Corporation in constructing and maintaining their lighthouses and lights, beacons and buoys, and the buildings and vessels belonging to the Corporation; in paying the necessary officers of their several establishments, and in providing relief for decayed seamen and ballastmen, their widows, &c. Many almshouses have also at various times been erected, which are maintained from the same funds. The present house of the Corporation is on Tower Hill; the Trinity House was formerly in Water Lane, where it was twice destroyed by fire. Of the thirty-one Elder Brethren, eleven consist of noblemen and heads of the government departments, admirals, &c., who are styled honorary brethren; twenty are maritime commanders, selected from the several branches of the merchant service, who have retired from employment, and recently one has been chosen from the service of her Majesty's navy. The younger brethren (who are unlimited in number) are or have been commanders of merchant-ships. Neither the honorary members nor the Younger Brethren derive any pecuniary advantage from their connection with the Corporation. The present master is the duke of Wellington. Mr. Pitt filled that office for seventeen years, and King William IV. was master at the time of his accession to the throne. Formerly, according to Stowe, sea-causes were tried by the Brethren, and their opinions were certified to the common-law courts and courts of admiralty, such cases being referred to them for that purpose. This is not however the practice at present; but two of the Elder Brethren now sit as assistants to the judge in the court of admiralty in almost all cases where any question upon navigation is likely to arise. The various duties of the Corporation are parcelled out among the wardens and different committees appointed for the purpose of discharging the same. One of the most important of these is the Committee of Examiners, before whom all masters of vessels in the navy, as well as pilots, undergo an examination. The deputy master and Elder Brethren are from time to time employed on voyages of inspection of their lighthouses and lights, beacons and buoys, not unfrequently in most trying weather and seasons; and they are also often engaged in making surveys, &c. on the coast, and reports on such matters of maritime character as are referred to them by the government. The sums paid to the deputy master and Elder Brethren for their services are—to the former 500*l.* per annum, and 100*l.* further as the chairman of all committees, and to each of the Elder Brethren 300*l.* per annum.

TRINO'DA NECE'SSITAS. This term, in Anglo-Saxon times, signified the three services due to the king in respect of tenures of lands in England for the repair of bridges, the building of fortresses, and expeditions against his enemies. All the lands within the realm were bound to contribute to these three emergencies, on the principle of their necessity for general convenience or safety; and for this reason every man's estate was subject to the *trinoda necessitas*, whatsoever other immunities he might enjoy. Even in royal grants to the Church of privileges and exemptions from secular services, the right of requiring contribution for these purposes was almost always reserved to the king. (Selden's *Janus Anglorum*, i. 42; Cowell's *Interpreter*, ad vocam.)

TRINOMIAL, the algebraical name for an expression which consists of three terms, as $a + b + c$, or $ax - bx^3 + bx^4$. [TERM.]

TRIO'DIA (from τρεῖς, three, and ὀδοὺς, a tooth), the name of a genus of plants belonging to the natural order Gramminaceæ. It has a racemose panicle; a 2-valved, many-flowered, nearly equal calyx; a 2-valved corolla, the external valve being divided into three nearly equal teeth, the middle one of which is straight. The species of this genus of plants are principally natives of New Holland; one only is a native of Europe, and is also found in great abundance in Britain.

T. decumbens, decumbent Heath-grass, has a panicle with a few racemose spikelets; calyx as long as the flowers; and the ligule a tuft of hairs. It is an abundant plant on wet mountain-pastures, and on heaths and moors. It is about a foot high, and is one of those grasses which will grow abundantly on poor wet soils. Animals do not however appear to be fond of it. According to Mr. Sinclair, the quantity of nutritive matter is small, which, combined with its late foliage in the spring, and the little after-grass it produces, does not render it a desirable plant for cultivation even on poor soils.

TRI'ONYX. [TORTOISES.]

TRIPHANE. [SPODUMENE.]

TRIPHA'SIA, a small genus of plants of the natural family of Aurantiaceæ, of which the species are found in the East Indies, Cochin-China, and China. The genus was named by Laureiro, from τριφασιος, triple. The calyx being 3-cleft, petals 3, stamens 6, rarely 5-8, filaments awl-shaped, flat, anthers cordate, oblong. Fruit baccate, 1-3 celled; seeds 1 in each cell. The species form thorny shrubs with simple or trifoliate leaves. The fruit of T. trifoliata is acid in taste, something like the orange, and is both preserved and eaten as a fruit. It is sometimes cultivated in gardens on account of the white sweet-scented flowers and orange berries. It requires heat with turfy loam and peat.

TRIPLE ALLIANCE means, in diplomatic language, a contract entered into by a formal and solemn treaty between three different powers, by which each of the contracting parties, by contributing its share to the execution of it, is also entitled to a proportionate share of those advantages which may be derived from it. Such a treaty may be concluded either for defensive purposes, when each power pledges itself individually to assist the other, or the others in case of attack; or it may be entered into for an offensive object, when the contracting powers engage to commence and carry on a war against a fourth party. It has been discussed by several writers on international law, whether two of the three contracting parties have a right, after a triple alliance or treaty has been concluded between them, to enter into separate stipulations in which the third party does not participate and is not privy to. This question has never been fairly settled, like many other intricate questions in that obscure branch of jurisprudence, and in case of difficulty the strongest hand would establish and maintain its own particular doctrine. Martens, however, one of the latest and most esteemed writers on the subject, is of opinion that no separate stipulations can be made without the consent of all parties, if three or more, and that this doctrine is recognised by all civilised nations. Powers allied by a treaty may in fact be considered as partners, who as such can enter into any agreements or treaties with other parties, without these other parties becoming participators in the first contract. For instance, this was the case in the late war, which resulted in the destruction of Napoleon's empire. Russia and Prussia concluded a treaty of alliance, defensive and offensive, at Kalish, which Austria afterwards joined; and this triple alliance, or partnership, entered afterwards as such into treaties under various conditions with Great Britain, Sweden, and almost all European powers, without these states however becoming parties to the original triple alliance.

A great number of triple alliances, some resulting in highly important events, are known in the history of the middle ages as well as in modern times. There is one however, which, if implicit faith could be placed in English historians, and particularly in Hume, might most appropriately be called the negative triple alliance; but as probably very few historical facts have been so much perverted and disfigured, it deserves a closer examination.

Charles II. of England, Frederick III. of Denmark, and the United Provinces of Holland, over which John de Witt at that time presided, were the contracting powers. Charles's political character, as well as that of most of his ministers, is too well known to require any comment. Frederick's strict honour and veracity have never been impeached. It was on him that the two estates of the kingdom, in the fullest confidence in his personal integrity, bestowed sovereign power. De Witt's profound sagacity and quickness of perception were proverbial at the time and nevertheless Hume, upon no other evidence than the word of Sir Gilbert Talbot, an English envoy in Copenhagen, repeated by Bishop Burnet, calls King Frederick's conduct extraordinary, perfidious, and shameful; makes Charles the injured sufferer; and De Witt a deluded dupe. The facts drawn from the most authentic diplomatic sources are shortly these:—From causes best known to himself, Charles declared war against the United Provinces in 1665, and was very anxious to secure the alliance of Denmark, then the second naval power of the north. Sir Gilbert Talbot received instructions for that purpose, and found King Frederick willing to listen to his proposals, because the United Provinces had a short time before begun materially to disturb the Danish commerce on the coast of Guinea, and had also made very unfair demands for the expenses of the more than doubtful assistance which they had given Denmark during the last war with Sweden. Preliminaries for a treaty were soon agreed upon, and were signed on the 15th of May, 1665, by which Frederick pledged himself to assist England with twenty ships of the line, upon receiving subsidies to the amount of 120,000 crowns per annum as long as the war continued. As soon as these stipulations were signed at Copenhagen, Sir Gilbert forwarded them to London, to be ratified by Charles. Towards the end of June (the precise date is not known), Sir Gilbert had an audience with Frederick, in which, according to his own statement, he explained that it would take two months at least before an answer could be expected from London.

In the mean time the Dutch, alarmed at this formidable alliance, sent a special mission, under the direction of the celebrated statesman Van Amerong, to Copenhagen, to induce the king to continue his friendship towards them, offering at the same time full satisfaction for injuries they had done to the Danish commerce. This embassy arrived about the same time that Sir Gilbert had the above-mentioned audience. Frederick, to gain time to see if the preliminary treaty concluded with Sir Gilbert would be ratified, or whether the rejection of it would leave him at liberty to adhere to his former allies, appointed commissioners to treat with the Dutch at Bremen, for the purpose of settling the indemnity due to Danish merchants for the spoliations committed on the coast of Guinea. On the 9th of August a Dutch fleet of fifty merchantmen, returning from the Mediterranean, entered the port of Bergen in Norway, and were on the following day joined by eleven East Indiamen, all richly laden, to seek protection against the English fleet, then cruising on the coast, under command of Lord Sandwich, who thought this too good an opportunity to fill the empty coffers of his king to let it escape. He therefore dispatched Sir Thomas Tiddiman, with seventeen sail, ships of the line and frigates, to attack and capture the Dutch fleet in a port which hitherto was neutral. He arrived in the outer port on the 11th of August, and sent an officer on shore to ask the commandant, Colonel Cicignon's, consent to his intended outrage, which was peremptorily refused. Sir Thomas then claimed the fulfilment of the unratified treaty of the 16th of May, which however contained nothing applicable to such a case. Upon this Colonel Cicignon became doubtful how to act, and dispatched a messenger to the viceroy, General Count Ahlefeld, for fresh instructions. The refusal was repeated by him in still stronger terms, and orders at the same time were transmitted to the commandant to defend the Dutch fleet to the last in case an attack should be attempted. Notwithstanding this, Sir Thomas Tiddiman made an attack on the fleet (August 13th), and, by the Dutch and Danes together, was beaten off with considerable loss. King Frederick was highly indignant at the treatment he had received from a power which had courted his alliance; and upon Sir Gilbert Talbot waiting on him to excuse the outrage, he cut him short, declaring that his negotiations with king Charles were at an end. As soon as the news of the Bergen affair reached London, Charles thought proper to ratify the treaty of the 16th of May, and to send a special envoy, Mr. John Clifford, with it to Copenhagen, who was instructed to apologise for Lord Sandwich's conduct, and to offer the king to remove him immediately from his command, if that would be considered sufficient satisfaction by Frederick: he was also the bearer of fresh instructions to Sir Gilbert Talbot, to use his best endeavours to pacify the king. In this however Sir Gilbert totally failed, and an offensive and defensive alliance was, about five months later (February 20, 1666), signed and ratified between Denmark and the United Provinces. Sir Gilbert left Copenhagen out of humour at his ill success; and, upon his return to England, asserted that the attack at Bergen, for which he himself had apologised and offered satisfaction to the king, in presence of three distinguished statesmen (Schack, Sehsted, and Klingberg), had been made in conformity with a verbal agreement which Frederick himself had proposed during the audience which he gave to the envoy in June; adding at the same time, that he (King Frederick) would take good care that plenty of Dutch ships should seek protection in his ports for the purpose of being robbed, and the spoils divided between him and king Charles. If this falsehood had not found credit in numerous pamphlets and histories of that period—if it had not been repeated by Bishop Burnet, then by Hume, and still more recently on the floor of the House of Commons, upon a most important occasion—it would scarcely be worth while to show the absurdity of it; but as it is, a few words will suffice to prove that Hume has done gross injustice to Frederick.

1. Sir Gilbert's assertion was promptly refuted and unconditionally denied in a publication written by Frederick's secretary, W. Bering, printed at Paris in 1666, under the title of 'Dissertatio de Bello Anglo-Danico ejusque Causis.' He says therein that he has the authority of his master, as well as that of the three above-mentioned witnesses, who were present at all the interviews which Sir Gilbert had with the king, to declare it false, and to defy Sir Gilbert to produce any proof for his assertion. This defiance remained unanswered.

2. Charles opened the parliament at Oxford, October 20th, before Sir Gilbert's return to England, and alludes in his speech to the Bergen affair as an unfortunate misunderstanding.

3. Can it be imagined that Frederick would enter into so important and treacherous an agreement with an envoy alone, without at least having his brother king to countenance him in his nefarious acts, and if this was the case, as Sir Gilbert and Burnet pretend, there was no time (from the end of June to the 11th of August) to obtain Charles's ratification and afterwards to send the requisite orders to the viceroy in Norway and to Lord Sandwich. But on this subject Hume is silent.

4. If Frederick intended to enrich himself by the plunder of the Dutch merchantmen, why did he not afterwards accept the satisfaction offered him by Mr. Clifford and Sir Gilbert Talbot, and then take the Dutch fleet for himself? But on the contrary, the fleet remained safe under his protection at Bergen till the middle of October, and then sailed under a Dutch convoy for Amsterdam.

Finally, Frederick's positive refusal to enter into any further negotiations with king Charles is not denied even by Burnet, and Hume nevertheless asserts that 'the king of Denmark, seemingly ashamed of his conduct, concluded with Sir Gilbert Talbot, the English envoy, an offensive alliance against the States, and *at the very same time* his resident at the Hague, by his orders, concluded an offensive alliance against England.'

This might truly be called a negative triple alliance. Now Sir Gilbert, clearly perceiving that his endeavours to recommence negotiations were in vain, left Copenhagen towards the end of October, 1665, and the treaty of alliance between the United Provinces and Denmark was signed at the Hague on the 11th of February, 1666, under much less favourable conditions to Frederick than those agreed to by king Charles in the treaty of May, 1665.

(*State Papers in the Royal Archives at Copenhagen*; Hume's *History of England*; Burnet's *History of His Own Times*, 6 vols. 8vo., Oxford, 1823; *Theatrum Europaeum*, 10 vols. fol., Frankfurt, 1703; L. Holberg, *Dannemarks Riges Historie*, 3 vols. 4to., Kiöbenhavn, 1735; *Histoire de Dannemarc*, par M. P. H. Mallet, 9 vols. 8vo., Paris et Genève, 1788.)

TRIPLICATE. [Ratio, p. 309.] In the common arithmetical sense, the triplicate of a given ratio is found by taking the cube of each of the terms of the ratio. Thus, when we say that two similarly formed solids, whose linear dimensions are as 4 to 7, are in the triplicate ratio of 4 to 7, it is meant that the bulks of those solids are in the ratio of 4 × 4 × 4 to 7 × 7 × 7, or of 64 to 343.

TRIPOD (*tripos*, τρίπους) is any article of furniture resting upon three feet, whence the name is given to tables, chairs, moveable altars, and other articles of the same kind. (Athen., ii., p. 49.) A chair or an altar of this kind must be understood when we read that the Pythia of Delphi gave her oracles from a tripod. We find also mention of tripods containing a certain measure of fluid (Hom., *Il.*, xxiii. 264), and in this case we have to understand a bowl resting upon a pedestal with three feet. The crater, or the vessel in which the wine was mixed with water at the banquets of the antients, was very frequently a tripod of this description.

The antients made much more frequent use of tripods than we, and from their descriptions, as well as from the numerous representations of tripods on medals, and from the specimens still extant, we see that they were often most tastefully ornamented and of the most exquisite workmanship. They were usually of metal, but sometimes also of marble, and appear to have been made as much for mere ornament as for use. The tripod was connected with the worship of several gods, and was one of their attributes; but there is no deity in whose worship tripods occur so frequently as in that of Apollo. Accordingly the Pythia gave her responses from a tripod, tripods were the most common presents (donaria) to his temples, tripods were given to the victors in the games which were celebrated in honour of Apollo, and tripods appear on innumerable coins which have any relation to the worship of that god. Some antient tripods are preserved in the British Museum.

(Compare *Dictionary of Greek and Roman Antiquities*, under 'Tripos.')

TRIPOLI is a country in Northern Africa, which extends along the southern shores of the Mediterranean, from 11° to 25° E. long. In this direction alone the boundary-line of the country is tolerably well determined; on all other sides it is surrounded by countries which form portions of the Sahara, or Great Desert, or are unfit for cultivation. Though Fezzan, which lies south of Tripoli, is governed by its own chief, he is really dependent on the Basha of Tripoli, as he pays regularly an annual tribute. If this country is included, Tripoli extends on the road to Bornou southward to the vicinity of the northern tropic, or nearly 700 miles from the shores of the Mediterranean. Along this road alone we are acquainted with the distance to which the authority of the Basha of Tripoli extends inland; on all other points we have no information at all. We are therefore unable to form any idea of the extent of the country and its area.

About the middle of the coast-line of Tripoli is a wide and open gulf, which the antients called the Greater Syrtis, and is now the Gulf of Sidra or of Sert. The Bedouin Arabs who inhabit the coast call it Giun el Kebrit, or the Gulf of Sulphur. Cape Mesurata is on the west side of it, and the town of Bengazi on the east; the distance between these places is, according to Beechey, 282 statute miles. The circumference of the gulf, according to the same authority, is 488 statute miles. Where it extends farthest to the south, its depth does not exceed 120 statute miles. This gulf was carefully avoided by the vessels of the antients, and it is still avoided by vessels sailing from Bengazi to Tripoli or Malta. The antient writers, Strabo (xvii., p. 835, ed. Casaub.) and Pomponius Mela (lib. i. 7), state that the dangers to navigation were occasioned by the frequent occurrence of banks and shallows formed by the flux and reflux of the sea, and still more by this flux and reflux themselves. In fact a great part of the coast of this gulf is so shallow as to make the landing very difficult. But modern seamen are at a loss to find out what is meant by the flux and reflux of the sea, as it cannot be the effect of common tides, which are so inconsiderable in the Mediterranean as not to affect navigation. Captain Beechey has given a very probable explanation; he states that the sea sets into the gulf, and that this inset is very great when the north and east winds, passing over the Mediterranean, which is here widest, blow strongly against the coast, and that small vessels must have found it extremely difficult to avoid being drawn into its vortex. Thus the flux is explained. The reflux is nothing else, according to Captain Beechey than the reaction produced by the great body of water, which by this indraught is accumulated within the gulf during strong northern and eastern winds, and which is driven by them over the low land surrounding the gulf: for an unbroken sweep of level ground, very slightly raised above the level of the sea, extends on the west coast of the gulf for 100 miles in length, and occasionally as much as 15 in breadth. The reflux of the water, driven over a tract of such dimensions, may well be considered formidable. But the improved state of navigation has stripped the Syrtes of the greatest part of their terrors.

Coast-line and Harbours.—West of the town of Tripoli the coast is low and sandy, and contains no harbour except that of Old Tripoli, which is almost choaked up with sand. Tripoli itself is a good harbour, having from 4 to 6 fathoms water, and being sheltered by a chain of rocks which project from the north-east angle of the town, north-eastward, and by a shoal lying on the eastern side of the entrance. The low and sandy coast continues eastward of the town as far as Cape Sciarra, and contains no harbour. Eastward of Cape Sciarra the coast is higher, and consists of rocky points and capes, with sandy bays between them, a few of which afford shelter for small vessels. The port of Lebda (the antient Leptis Magna) is now filled up, but there is a small place, called Mersa Ligatah, a mile and a half to the west of the ruins of Lebda, where small vessels find a shelter, except when the wind is from the east. Near Zeliten Point, which is rocky, is a small cove called Mersa Zeliten. East of Zeliten the coast is rocky and at times rises into cliffs. Along this coast are several reefs of rocks which form Mersa Zoraig and Mersa Gusser, small harbours which do not afford shelter for shipping. Near Cape Mesurata is a line of high rocky coast, forming three projecting cliffs, of which the eastern is Cape Mesurata, the Cephalus Promontorium of Strabo. But the entrance of the Gulf of Sidra is formed by a low rocky point, and a mile south of it is the Bay of Bushaifa, which has good anchorage in six fathoms water.

The west coast of the Gulf of Sidra, south of the Bay of Bushaifa, and as far as Mersa Zafferan, runs in an unbroken line south, south-east, and east for nearly 150 miles. It is very low and sandy, and a low ridge of sand-hills extends parallel to the shores at the distance of from one to three miles from them. Some parts of this coast are strewed with wrecks, masts and yards, &c., which shows that there must be a great set of the sea from the north-east upon it, as none of them are seen on the eastern shore of the gulf. Mersa Zafferan is a small port, in which boats may find shelter with all winds. A few miles east of it the coast rises into cliffs. The high coast continues for nearly 30 miles, when it again sinks nearly to the level of the sea, but has sand-hills a short distance from it. There are here several small bays, and one in particular at Hammah, in which boats may find shelter. Five miles eastward of Hammah the coast is hilly, but soon declines again to the low sandy beach which continues to Ras How-y-jer, having a range of hills about two or three miles from the coast. Ras How-y-jer is a bluff rock, which stands at the entrance of a spacious bay, formed between it and a bold rocky promontory called Bengerwad. In this bay ships may find shelter from east to west-north-west, and boats may land in the sandy bay with almost all winds. Bengerwad is about 60 feet high, but east of it the coast gets low, and small sandy bays are formed between very low rocky flats, some of which project a mile into the sea, and are not more than a foot above water. Towards the most southern extremity is a low rocky islet called Bushaifa. Sachrin, at the bottom of the gulf, is in 30° 16′ N. lat.; and hence the coast trends to the north-east. From Sachrin to Gartúbbah is a sandy beach, but the general appearance of the coast is hilly. Near Gartúbbah is Mersa Braiga, the only place in the Gulf of Sidra that is entitled to the name of a port; and here the protection is made by breakers. A rocky point runs into the sea, and within this point there is always safe landing. From Braiga the coast trends north-east by east; is rocky and slightly indented, and the shore generally speaking is high and hilly. Ras Tabilba is a bold promontory with a sandy bay on each side of it. The high rocky coast terminates opposite the rock of Ishaifa, from which some reefs extend to the island of Gara, which is small, but tolerably high and steep. The low coast, which begins near Ishaifa, trends north-east to Shawhan, and thence to the west of north to Carcora: it is sandy, and does not offer a place of refuge even for a boat: but the coast near Carcora is much indented, and there are two small places somewhat sheltered by projecting points, which offer protection for boats with northerly or easterly winds. From Carcora to Bengazi the shore is low and sandy, but it rises as it recedes from the coast, and is covered with vegetation.

Bengazi, which is situated at the entrance of the Gulf of Sidra, has a safe port, which however is fast filling up with sand. [BENGAZI.] The coast north of that port trends in general to the east-north-east as far as Cape Ras Sem, and is low and sandy, with the exception of a few small hills. This coast has no harbour, except east of a rocky promontory near the ruins of the town of Ptolemeta, where a small bay offers a convenient landing for boats, except with the wind on shore. A few miles east of Ptolemeta the mountains, which extend over the interior of Barca, come close up to the shore of the Mediterranean in steep precipices from 600 to 800 feet high. This part of the coast, extending about 30 miles in length, is inaccessible both by sea and land, and terminates at Cape Ras Sem. Between this Cape and that called Ras el Hilal is a large open bay, in which is a small indentation called Mersa Susa Hammám, near which are the ruins of the antient town of Apollonia. It has at present no harbour, but boats find some shelter behind the islet that lies off the town. On the east side of Ras el Hilal is a bay about three-quarters of a mile deep, in which vessels may ride with the wind any way from the southward to westward. The coast between Ras el Hilal and Cape Bujebára is also very high and rocky, but the mountains do not run in an unbroken line, as they do west of Ras Sem, being broken by deep chasms, which extend far inland. Still the landing is very bad, except in a small sandy nook two miles west of Cape Bujebára. From Cape Bujebára the same rocky coast continues, but the ravines are few, and the mountains are somewhat farther removed from the coast. At *Derna* is a good roadstead, about a mile and a half off shore, and some shelter for small craft close in shore with the wind from north-north-west to north-east. Cape Razat, or Razat, which is east of Derna, is a vast promontory rising to a considerable elevation: farther east the coast grows lower, but continues rocky; it recedes to the south so as to form a wide bay, called the Bay of Bombah, which is said to contain good anchoring-ground. The boundary line between Tripoli and Egypt is considered to be east of the Bay of Bombah.

The coast-line of Tripoli probably exceeds a thousand miles, and hardly contains three or four harbours in which vessels of moderate size can find tolerable shelter. There is perhaps no other coast-line on the globe of equal extent which is so little favourable to intercourse with countries by sea.

Surface and Soil.—We are very imperfectly acquainted with the interior of Tripoli. The western districts, or those which are situated west of the Gulf of Sidra, have indeed been traversed by several British travellers in their attempts to penetrate into the central countries of Northern Africa, and thus the country has become known at least in a few directions: but of the country surrounding the gulf nothing is known except the districts contiguous to the sea-shore; and as to the countries east of the Gulf of Sidra our knowledge extends hardly anywhere farther than about 20 miles inland, if we except two oases, which are situated far to the south, in the Desert.

Western Region.—Two ranges of mountains traverse this part of Tripoli from west-north-west to east-south-east, running nearly parallel to the sea. It is probable that their western extremities are connected with the Nofusa range, the most eastern offset of Mount Atlas. [ATLAS, vol. iii., p. 32.] The northern of these two ranges is called the Ghurian, Gharian, or Wáhryan range, and is visible from the sea, being only from 15 to 20 miles distant from it. The southern range is supposed to be about [illegible] miles farther to the south, and is called the Sudah, or Black Mountains, where it is traversed by the road leading from Tripoli to Fezzan, the only part where it has been seen by travellers, and at this place it is within the territories of Fezzan. Within the boundary of Tripoli it has not been visited, but it is known that the commercial town of Ghadamis is situated within this range, and rather on its southern declivity. The name Black Mountains is derived from the colour, as nearly the whole of the range is covered with lava and basalt. We are better acquainted with the Ghurian Mountains, which, south of the town of Tripoli, seem to have a considerable elevation, probably however not exceeding 4000 feet above the sea-level. In proceeding farther east the range lowers considerably, and its most eastern offsets, which occur about five or six miles south-west of the town of Mesurata, terminate only in high hills. Several minor ridges branch off from the eastern portion of this range on its northern side, and approach close to the Mediterranean between Cape Sciarra and the ruins of the town of Lebda. The most western of these minor branches is called the Tarhoona Mountains: it hardly attains a thousand feet above the sea.

The country which is enclosed on the east by the Tarhoona Mountains extends southward to the base of the Ghurian range, and on the west reaches the boundary of Tunis: it is a low and level plain, about 60 miles long and 16 miles on an average width. It is by nature divided into two sections, the fertile district and the desert. The fertile district, called Mesheea, occupies only about 15 miles along the sea-coast, and the greater part of it is to the east of the town of Tripoli: its width nowhere exceeds five miles. Though the soil is light and contains a great portion of sand, and is destitute of rivers and springs, it possesses a high degree of fertility, which, by means of irrigation, derived exclusively from tanks and cisterns, produces rich crops of wheat, barley, dhurra, and Indian corn. The whole of the Mesheea is planted with palm-trees arranged in long rows, which are kept in the finest order. Their number is stated to exceed ten millions, and the annual value of the produce of each tree is estimated at a Spanish dollar. The plantations of olive-trees are also extensive, and the oil is considered superior to the best oils of Italy. There are several kinds of oranges, of which the sweet orange is reckoned finer than that of China. The pomegranates, lemons, limes, figs, and Indian figs are highly prized. There are two kinds of apricots, several sorts of fine plums, and some very high-flavoured sweet grapes and peaches. Water-melons are particularly excellent and plentiful. From November to March the country is refreshed by abundant rains, which fill the numerous tanks and cisterns; and in this season the thermometer descends frequently to 40° and even to the freezing-point in the night-time, whilst in the day it sometimes rises to 70° and even higher. In the remainder of the year, and especially from the middle of May to September, rain occurs rarely, and sometimes not a drop falls for several months. The heat is then so intense, that even the hardy Arab, inured to the climate, at ten in the morning retires from his work, and all his beasts of labour are put under the shade. The heat abates nothing of its oppression till a sudden cool breeze arises from the sea, which happens regularly every afternoon during these intense heats; but the air brought by it from the sea is so damp that it rusts all sort of steel-work, even in the pocket, and wets a person's dress entirely through in a few minutes. The Moors then retire to the terraces on the top of their houses, where they sleep for hours. In this season of the year a strong land-wind sometimes blows incessantly for several days. Usually it lasts only for three or four days, but sometimes, though not frequently it continues for ten or twelve days. As it blows over the heated sands of the desert, which lie south of the Mesheea, the heat of the atmosphere is increased to such a degree, that respiration is rendered difficult, and death sometimes occurs. The air is at the same time filled with burning sand, which darkens the sky, and the natives wear a silk handkerchief tied over the face when they walk the streets. In spite of this disadvantage the climate is very healthy; no kind of disease except ophthalmia is common, and many people are said to reach the age of 110 and 130 years. The Mesheea is very thickly peopled, so that the population of this district is said to amount to 300,000 individuals. They live dispersed over the country in isolated dwellings or in villages.

The Mesheea is surrounded on all sides, except the sea, by a desert, whose surface consists of loose sand. This long sandy tract begins on the east on the banks of a small river called Wady'm Seyd, and thence stretches westward to the Ghurian Mountains, occupying nearly the whole of the space between the mountains and the sea west of the town of Tripoli. Its western portion has no springs nor running water. Where it borders on the Mesheea, and at the distance of several miles from it, the sand rises in irregular hills, and is totally barren. But in approaching the mountains small spots covered with shrubs and grass occur, which afford pasture to the flocks of the Beduins, and near the base of the mountains the pasture-grounds are nearly contiguous to one another, and frequently interspersed with corn-fields. The eastern districts of the Desert, or those near the Tarhoona range, are also covered with high sand-hills, which reach to the base of the mountains, but they are traversed by two small perennial streams, called Wady Ramleh and Wady'm Seyd, which run in rather narrow valleys, considerably depressed below the general level of the Desert. These valleys are covered with bushes, and between them corn-fields often occur. Barley and dhurra are cultivated.

The Ghurian Mountains, south of Tripoli, occupy a tract 12 or 15 miles in width. The northern declivity appears to be very irregular, several hills of basalt being dispersed over their base. The mountains rise with a rather steep ascent, but on the top they spread out in plains of moderate extent, which are divided from one another by hills, many of which have a conical form. The plains are in a high state of cultivation. They are covered with corn and saffron fields, interspersed with olive-trees, but the elevated situation prevents the cultivation of the palms. The sides of the hills, which are too steep for the growth of corn, are planted with almonds, figs, apples, olives, and vines. A considerable portion of this tract however is used as pasture-grounds. The inhabitants of the Ghurian Mountains live mostly underground, in caves which have been dug for the purpose.

Farther to the east, and where the Tarhoona Mountains branch off, the mountain-region sinks much lower and assumes a different character. It is a table-land about 30 miles in width, which runs towards Cape Mesurata, and only on its edges assumes the aspect of high hills or mountains, especially towards the desert which lies north of it. The greatest part of the surface of this table-land is a plain, nearly level, whose soil is very stony, or covered with gravel, and completely barren. But in the vicinity of the higher grounds which enclose it on the north, it is furrowed by depressions, or wadies, which are partly cultivated, and yield good crops of corn, and the level grounds separating them are covered with fine grass for sheep and camels.

The eastern portion of this table-land, in approaching the Gulf of Sidra, splits into several short ranges of hills, which fill up the space between Cape Sciarra and the town of Mesurata, and in many places come close up to the sea. Thus a hilly tract is formed, which extends about 60 miles from west to east, along the seashore, and from 5 to 6 miles inland, where it terminates on the plain of the table-land. This tract is the best-watered district in Tripoli, as several small streams which descend from the table-land run through its valleys, and reach the sea after a course of 6 to 8 miles, but there is always water in them. The western district consists of a succession of hill and dale. They possess a considerable degree of fertility, and produce wheat, barley, and dhurra. In the eastern districts the hills are separated from the sea by a level plain about two miles wide, which in two places is interrupted by ranges of low hills, so as to be divided into three plains of moderate extent, which are known as the plains of Lebda, Zeliten, and Mesurata. The hills south of them are mostly pasture-grounds, between which some corn-fields are found; but the plains themselves, which slope gently towards the sea, are well cultivated. Thick groves of olives and date-trees rise above the numerous villages, which are scattered over their surface, and the intermediate spaces are either covered with the most luxuriant turf or rich with abundant crops of grain. The plains of Lebda and Mesurata especially are distinguished by their rich crops of corn, and large quantities of it are sold to the wandering tribes living east of them or exported by sea. The cultivated grounds in the plain of Mesurata extend along the shores of the Gulf of Sidra as far as Bushaifa. A ridge of low sand-hills separates the plains from the sea.

The country south of the table-land, extending to the Sudah Mountains, contains a much smaller portion of cultivated ground than that north of it. The greater part of it is a complete desert. According to the scanty information which we are able to collect from the works of the few travellers who have traversed this tract, it appears that its surface presents a succession of several wide depressions, running from west to east, and terminating on the east in the low grounds which extend along the western shores of the Gulf of Sidra. From each of these wide valleys smaller valleys branch off, and penetrate a few miles into the higher grounds, which enclose them. These higher grounds are many miles wide, and rise rather steep above the valley to an elevation of 400 to 500 feet. A large portion of them is probably 1000 feet above the sea-level. Their surface is neither level nor yet hilly. It presents everywhere a useless waste, though it greatly varies in aspect. At some places it is what the natives call a *sahár*, or a level plain consisting of loose sand, without either stones, rocks, water, or vegetation. Other tracts, called *sereer*, are gravelly plains from which the sand has been swept by the winds. The gravel is generally small; in some instances rounded as pebbles on the sea-beach, in others sharp and pointed as if recently broken; and a third kind, which sometimes covers spaces of many miles in extent, is mostly composed of small stones which have a shining exterior. In the sereers alone sand-hills are found. A third kind of desert is called *warr:* it presents a rough plain covered with large detached stones lying in confusion, and very difficult to pass over, as its surface is much broken and interspersed with numerous rocks and small hillocks. A few spots in these deserts are covered with bushes. The few wells which are found on these deserts are generally above 100 or even 200 feet deep, and yet their water is bitter and brackish. The habitable portion of this region is limited to the depressions above mentioned, where several villages are found close together, whilst all the other parts are uninhabited. But even in those districts which are far from the villages a few fields are cultivated and produce barley and dhurra. The inhabitants of the villages cultivate them, but do not venture to form agricultural settlements on them for fear of the wandering tribes of the adjacent desert. These valleys have generally a watercourse in the middle, in which however water is found only for a few weeks in the year, as the rains south of the Ghurian Mountains and the table-land are far from being so abundant as north of them. The greater part of the depressions is overgrown with shrubs, and supply only pasture for camels, sheep, and goats. The most fertile of them is that of Benioleed, which is situated on the south of the table-land south of the Tarhoora Mountains. The *warr* which borders on the south of the valley of Benioleed is covered with lava and columnar greenstone, and is of great extent.

Country on the West and South of the Gulf of Sidra.—The region just noticed does not reach the western shores of the Gulf of Sidra, being separated from it by a tract of very low country, or rather by a marsh. This marsh begins at Bushaifa, about 4 miles south-east of Mesurata, and extends along the sea-shore as far as Giraf, a distance exceeding 100 miles. It reaches however the beach only in two places, being separated from it by a narrow tract of more elevated ground, which consists of small but irregular heaps of sand, with occasionally a little vegetation on it. The marsh is widest in its most northern part, between Mesurata and Sooleb, which are 40 miles from one another. In these parts it is from nine and ten to fifteen miles wide. In approaching Sooleb it contracts to two or three miles, but widens again farther south to four and five miles. At the end of the rainy season, in March, nearly the whole surface of this marsh is covered with water. At the end of the dry season by far the greater part of it is dry, but interspersed with numerous pools of water. Many of these pools are some miles in extent. The surface of the marsh consists of alternate layers of incrustations of salt and of an alluvial deposit, and is entirely destitute of vegetation. In some parts small shells cover the surface, which renders it probable that the sea at times inundates the marsh. In the most level part of the marsh many places occur in which a solid crust, sometimes not more than two inches or an inch and a half in thickness, covers deep hollows, the lowest parts of which contain bitter and stinking water several feet deep. This circumstance renders the traversing of the marsh very dangerous. In this extensive tract of country the habitable ground is limited to two or three low hills, which rise within the marsh, and on which date-groves are met with, and to three or four places where the narrow tract along the sea is somewhat wider, and consists of high ground covered with grass and bushes, which afford pasture to sheep and camels. This is the worst part of Tripoli bordering on the sea. Della Cella speaking of it, says, 'The country contiguous to this part of the Gulf of Sidra is flat and very little raised above the level of the sea, and though the shores are lined with sand-hills, they are for the most part shifting and frequently dispersed by hurricanes. In winter the waters of the sea are forcibly driven upon the African coast, and currents running from north to south greatly increase the water in the Gulf. I am disposed to think that under these circumstances the sea, breaking down the sandy ramparts upon the beach, spreads itself over the adjacent plains, and inundates a considerable tract of the country. Thence it happens, that the large pools of salt-water, although disunited in summer, form in winter one large and spacious lake communicating with the sea as long as particular causes keep up its level to a certain height. When these causes cease, the communication terminates, and the return of heat promoting evaporation, the lake dwindles into different pools, and the spots which the water had occupied remain marshy. But when their edges become quite dry, abundant deposits of marine salt are formed upon them. The stratum of sand which covers these deposits is no obstacle to this process; for the whole of the soil is sandy, and the porous qualities of these sands powerfully promote the evaporation of the salt-water beneath them.'

Though the Gulf of Sidra is enclosed by countries entirely barren and sandy, the tract which is found farther east, and which extends from Giraf (16° 30′ E. long. Hudía (18° 30′ E. long.), a distance of more than a hundr miles, has a different character. Its surface in general undulating, in a few places even rising into hills. The hills are mostly covered with shrubs and grass, afford good pasture-ground for camels, sheep, and goats. some of the lower tracts are fields on which the Bedu the inhabitants of this coast, cultivate barley and dhur But there are no trees in all the tracts surrounding t Gulf of Sidra. In a few places there are lagoons n the sea, but they are not of great extent, and the o marshes which are met with in this country are on th banks of these lagoons.

The country occupying the bottom of the Gulf is o much worse description. It extends from Hudía to Br (19° 40′ E. long.), a distance of more than 60 miles. T shores of the sea are lined with low sand-hills, which h been accumulated by the northern wind from the s thrown up by the sea. Behind them, marshes frequent occur, or the ground is a rough stony plain, nearly with vegetation. In a few spots only bushes and grass are with, and in these parts a few families of Beduins wa about with a small number of camels, sheep, and g Della Cella asserts that in this part the Great Desert, or Sahára, extends to the shores of the sea, as according to observation no hills appear to lie between the sand-h and the desert. But Captain Beechey found that at a li distance from the shore a continuous ridge of hills exte which rise to an elevation of between 400 and 500 above the sea-level, and are not composed of sand, but more solid material. The nature of the country south these hills is not known.

Respecting the climate of this region, it is observed in winter the atmosphere after sunset is always very ch and that there is usually a heavy deposit of dew. In sum mer however the weather is said to be excessively sultr

Country east of the Gulf of Sidra.—This part of Trip is commonly called Barca [BARCA], and was known to th antients under the name of Cyrenaica. It comprehends t country which, between 20° and 23° E. long., projects in the Mediterranean nearly in the form of a semicircle, a the countries lying south of it as far as about 29° N. lat. is supposed that the greater portion of it is mountain which is very probable, if the mountains which Hor mann had on his right in passing from Siwah to Au constitute the southern edge of the region. In this ca the mountain region would extend over three degrees a a half from south to north, or about 250 miles. Its ext from west to east is nearly the same, as the western bor lies near 20°, and its eastern near 25° E. long. The weste border approaches 20° E. long. within about 15 miles, a the eastern is connected with the mountains which s round the oasis of Siwah. On the north it comes clos to the sea, between 21° and 25° E. long.; on the west it separated from the shores of the Gulf of Sidra by a plain. This plain, which is called the *Plain of Beng* from the town of that name, extends along the east shores of the Gulf of Sidra, from Braiga to Ptolemeta, a distance of about 180 miles in a straight line. Its width varies greatly. It is not known south of 31° N. lat.; but in that parallel it seems to be more than 20 miles across. Farther north the mountain region approaches near the sea, and it grows narrower. At Bengazi it is 15 miles, at Teuchera 5 miles, and at Ptolemeta one mile and a half wide. At a moderate distance from the last-mentioned place it terminates, as the mountain region in this part comes close to the sea. The surface of this plain in its southern districts is very uneven, as there appear extensive ledges of rocks rising to some elevation above the general level, and in other places, especially near the shores, the country is covered with sand-hills and swampy tracts. Agriculture is here limited to a few plains of moderate extent, where dhurra and barley are grown; but nearly the whole of the country is fit for pasture-ground, and the flocks of sheep, goats, and camels are large; cattle are only found in small numbers. North of Carcora (31° 30′ N. lat.) the soil is of better quality, and a large portion of the plain is under cultivation. A great part of the country, from Ghimenes to Bengazi, is encumbered by blocks of stone placed upright in long lines, which are crossed at right angles by others, so as to form a complete labyrinth of enclosures. This peculiarity appears to be occasioned by the nature of the soil, which, although rich and excellent, is covered with a layer of stone of various thickness, which it is necessary to break up and remove in order to cultivate the soil beneath it. The surface of this country is much more regular, sloping gently from the mountains which extend east of it to the sea, and being only in a few places interspersed with hilly tracts of small extent. The plain however is furrowed by numerous ravines considerably depressed below its general surface, which traverse it in the direction from the mountains to the sea, and in the rainy season carry down a great volume of water, but in summer they are dry, and it does not appear that there is in any part of the plain a perennial stream. The plain, where it is not cultivated, is thickly covered with wood and shrubs, and supplies good pasture. The sides of the mountains and the ravines are likewise overgrown with wood, and exhibit a luxuriant vegetation. Wheat and barley are extensively cultivated and are articles of export. The soil of the plain is a mixture of rock and very fertile earth, without any sand, and is capable of a high degree of productiveness. Along the sea there is a sandy tract which extends about half a mile inland, but with little labour it gives an abundant produce. The first care of the cultivator, says Beechey, is to turn up the sand and spread layers of faggots underneath; the sand is then replaced, and over it is sometimes spread a mixture of sand and manure. Upon this the seed is sown, and care is taken to keep the land irrigated by means of numerous wells of a foot only in depth. Thus the sand is soon rendered so productive, that the Arabs prefer cultivating it, to the trouble of clearing the rich soil beyond it. A portion of this sandy tract is used for plantations, of which those of palm-trees are very extensive. There are also grown melons and pumpkins, egg-plants, cucumbers, tomatas, red and green pepper, and some other plants.

In this plain the rainy season commences towards the middle of January, and continues with little interruption to the beginning of March. The rains are extremely heavy, and the streets of the town of Bengazi during part of the time are literally converted into rivers. The rain is accompanied with constant gales of wind from the north-east and north-west. Showers are frequent in the months preceding and following the rainy season, but during the summer months they are very rare; and as the heat is intense, the bright green which the country exhibits after the rains is changed into a dusky brown when the summer draws to a close.

The mountain region of Barca has only lately been visited by some European travellers. The information thus obtained appears to support the opinion that this extensive tract is an elevated table-land, with a surface generally hilly. Della Cella asserts that its general level may be estimated at about 1500 feet above the sea-level. Beechey says that two ranges of mountains are seen from the sea, between Cape Ras Sem and Ras Hilál, of which the northern, or that nearest the sea, according to a trigonometrical measurement, is 1055 feet, and the southern 1992 feet above the sea.

As to its productive powers the region may be divided into two sections, the dividing-line between which perhaps lies a short distance east of the plain of Ghrenna, or the antient Cyrene. The western districts are covered with hills of tolerably steep ascent, which are separated from one another by depressions, and occasionally a level tract. These depressions, as well as most of the hills, are overgrown with thickets of pine, cedar, laurel, laurestinus, carob, cypress, myrtle, box, arbutus, and various other kinds of trees and shrubs. In some places pines of considerable size occur. A portion of the valleys and plains is under cultivation, and produces plentiful crops of barley. The pastures of these tracts are superior to those of any other part of Tripoli, and the number of black cattle are more numerous. The larger number of those which are exported from Bengazi to Malta and other parts of the Mediterranean come from these districts. The vegetation is exceedingly luxuriant.

The ruins of the town of Cyrene are on the edge of a range of hills about 800 feet in height, descending in terraces which are terminated by the level ground that forms the summit of the second range beneath it. [Cyrene.]

East of the elevated plain of Ghrenna the nature of the mountain region changes. The country becomes stony and the soil arid. The vegetation is less vigorous, and diminishes gradually as we proceed eastward. The trees decrease in size, and are soon replaced by bushes, which first cover the slopes of the hills; but gradually these bushes and shrubs are interspersed with large tracts of stony ground almost entirely destitute of vegetation. At last only cypress bushes are met with on the sides of the hills, with some juniper and myrtle. The ground in these parts is extremely broken, and the numerous hills rise with very steep declivities. This circumstance renders this part of Barca less fit for pasture, and as agriculture is limited to a very few spots of small extent, this district is much less populous than those farther west; it is however traversed by the largest body of water found in Tripoli, the Wady Elthroon, which flows from an immense fissure in the mountains between Ras El Hilál and Cape Bujebára, and brings a considerable volume of water down. Nearly everywhere the mountains run up close to the sea, and the narrow beach along their base is almost blocked up by immense fragments of rocks, which have fallen down from the adjacent heights. There occurs however a plain, several miles in length, in which the town of Derna is built. This plain is narrow, being enclosed on the south by a range of very steep and barren mountains, which are from a mile to a mile and a half from the sea: it is of great fertility, though only a small portion of it is cultivated and planted with trees. If we may draw a conclusion from its productions, the climate must be hotter than any other part of Barca, as here alone plantains (Musa paradisaica) are cultivated with success. There are also extensive plantations of date-palms, vines, pomegranate and olive trees; oranges, lemons, figs, apricots, and other fruits are also abundant. A considerable portion of the country near the town is cultivated with wheat and barley, and irrigation is well understood. Beechey thinks that Derna has in most respects a decided advantage over every other town in Tripoli. A great quantity of honey is collected on the rocky mountains south of the plain.

The interior of the mountain region, as already observed, is not known. It is uncertain if it extends to the mountain-range which was seen by Hornemann in passing from Cairo to Fezzan; or if, as it is represented on the map of Pacho, it is separated from it by a wide and sterile depression. The authority of the basha of Tripoli however extends much farther south, as the oasis of Augila is within the country governed by him or his deputies. The mountain-range which lies to the north of this oasis runs in an unbroken line east and west. It rises from the level ground at its base abruptly, and consists of bare rocks without the least covering of soil. Pacho discovered, three days' journey west of Augila, an extensive depression, which apparently had formerly been covered with water and formed a lake. Respecting the oases which are found south of the mountain-range we shall only observe that that of Augila [Vol. iii., p. 83] consists, according to Pacho, of three oases, Augila, Ialloo, and Leshkerreh, of which the two last mentioned are a short distance to the east and north-east of Augila itself. All three, taken together, contain a population of from 9000 to 10,000 individuals. They are only forests of palm-trees, surrounded by an immense plain of red sand. The wells are more than twenty feet deep, and the water brackish. Dhurra and barley and a little wheat are cultivated, but provisions, consisting of corn, butter, and cattle, are imported from Bengazi. The exports consist especially of dates and ostrich feathers. Ostriches are numerous in the adjacent desert. Three smaller oases occur between Augila and the southern extremity of the Gulf of Sidra, nearly equally distant from these places. The most western and largest is called Maradeh. They are forests of palm-trees, surrounded by hills of shifting sand. As they are too small to afford sustenance to a population sufficiently numerous to resist the attacks of the nomadic tribes of the desert, these oases are uninhabited, but some families living in the plain of Bengazi resort annually to them to gather the dates.

From the routes collected by Captain Lyon, it appears that a considerable oasis, called Fuggha, is situated south of the most southern part of the Gulf of Sidra. It seems to be situated in the basalt mountains called Harutsh, which extend westward to the very boundary-line of Fezzan. [Fezzan, vol. x., p. 253.]

Productions.—Besides the different articles of agricultural produce before mentioned, a few plants require mention. In the wadys of the desert grow some bushes bearing small black berries of a very sweet and agreeable taste. The leaves of a small bush in the desert are boiled and eaten; their flavour is not unpleasant. In some parts a kind of sedge (Cyperus esculentus, L.) is found, whose roots are eaten; in others a kind of wild artichoke is met with. Prickly-pears and aloes are abundant in several places which are cultivated. The wild trees and bushes are only used to make charcoal. Where charcoal is not to be had, camel's dung is used as fuel.

Cattle are not numerous in Tripoli, except in Barca, where great numbers are found on the table-land, whence they are sent to Bengazi to be shipped for Malta and other places. The domestic animals are horses, camels, sheep, goats, dogs, and poultry. The horses are of a fine breed, but they do not acquire a handsome appearance for want of good food, except in the town of Tripoli, where they are treated with more care. Camels are the only animals used as beasts of burden. The common dogs of the country are white, and resemble wolves in form: they are fierce, and defend the herds against the attacks of the hyænas and jackals. The most common wild animals of prey are wolves, foxes, hyænas, and jackals. There are antelopes, gazelles, the jerboa dipus, hares, rabbits, hedgehogs, and a small animal, resembling the guinea-pig in form, called gundy.

Ostriches are only found in the deserts, especially south of the mountain region of Barca. The other wild birds are bustards, cranes, plovers, quails, ducks, snipes, curlews, pigeons, and partridges. On some lakes near the shores of the Gulf of Sidra flamingoes are frequent. Swarms of locusts frequently proceed from the deserts to the cultivated ground, and are not unwelcome to some of the inhabitants. The proprietors of the fields generally succeed in frightening them away, and then they fall into the hands of the poor, who eat them roasted or salt them. Salted locusts appear to be a considerable article of inland trade. Bees abound in the hilly and mountainous tracts of the country, and honey is an important article of inland trade. Small quantities of honey are exported.

Metals do not appear to be found. Salt is found in many parts of the desert and on the shores of the Gulf of Sidra, but it is not collected as an article of trade. About 50 miles west of the town of Tripoli, at a place called Zoara, rock-salt is found, and is worked. There is sulphur at a place called Kebrit, about two days' journey from Braiga, to which place the produce is brought to be exported. An earth impregnated with sulphur is found at several places not far from the shores of the Gulf of Sidra, and is sent thence to Egypt and Tripoli, where it is used as a remedy for the diseases of camels.

Population and Inhabitants.—Geographers have commonly estimated the population of Tripoli at one million of individuals; but this estimate is certainly below the truth, and was made when a great part of the country was unknown: it is more probable that the population is not less than two millions.

The population in the country consists of Arabs and Jews; in the towns, mostly of Moors and Jews: there is a small number of Turks, Mamelukes, Christians, and Arab Black slaves are numerous in the towns.

The Arabs of Tripoli, who compose the bulk of the people, are of the same stock as the Beduins of Arabia, as is proved by their language, which, in some parts, is not much different from the Arabic, though in others it is intermixed with a great number of words derived from other languages. They are, generally speaking, tall, straight, and well formed, and inclined, from their manner of living, to be thin and muscular. Their countenances are expressive and handsome, their form of face oval, and their noses aquiline: the noses of the females are usually straight and well formed; their eyes are black and large, their lips small, and their teeth extremely white. Although naturally white, their complexion becomes dark from exposure to the sun and from being not very particular in their ablutions. They are active, capable of undergoing great fatigue and abstinence from food, lively in their manners, daring, and possessed of great cunning: though generous, they are great beggars, revengeful, and unforgiving. When young, the females are exceedingly pretty, but the old women are very ugly. The old women frizzle their hair over the forehead, so as to make it project to some distance; and they dye it of dull-red with the leaves of a plant called henna, which gives it the appearance of red wool. All the females have a practice of tattooing their chins, the tips of their noses, and between the eyebrows. Both sexes blacken their eyelids with kohol, lead-ore powdered, which adds much to the brilliancy of the eye, and makes it appear larger than it really is.

There are two kinds of Arabs in Tripoli; one wanderers, the other fixed residents in villages and small towns. Many of those who live in villages also travel about the country, but always return to what they consider their home. The wanderers have no permanent place of abode, but remove their tents as pasturage or circumstances require. Their tents are made of woollen cloth coarsely woven in long pieces and sewn together. The tents spread to a great breadth, but are not high, the entrance being about six feet, and the top sloping gradually down till it is fastened to the ground. These tents are called 'hair-houses.' There are large tracts in the deserts which are partially covered with grass and bushes, and afford pasture for sheep, goats, and camels, but it frequently happens that they are far from any well. Capt. Lyon observes that not only the Arabs and their camels, but all animals in the desert, have the power of remaining a great length of time without water. Sheep, provided they have tolerable herbage, will pass even a month without drinking. Antelopes and wild cattle in some cases never taste water, none being found on the surface of the desert. The wandering Arabs cultivate some small tracts with barley or dhurra. These fields are usually at a great distance from the places to which they go with their flocks, but they are respected by other wanderers, and the corn is rarely stolen. When it is ripe, the proprietors come to gather it. They prepare the soil by turning up the earth with a rude plough, or more generally with a hoe. When the date season commences, many families come and pitch their tents in the Mesheea of Tripoli, in order to purchase dates for their future subsistence. These they deprive of their stones, and, when kneaded together, keep them in skins, so as to preserve them from insects or wet: these dates form their chief support, with the milk of their sheep and camels. The butter, called manteca, which they obtain from the milk of the sheep (that of the camels does not throw up cream), is boiled with a little salt until it becomes like oil, and is then poured into goats'-skins, and is fit for use or the market. A great article of commerce is furnished by the fat of sheep. It is boiled until it bears some resemblance to the grease used by tallow-chandlers; it is then poured into skins, and is fit for use. It is into almost every article of food by the Arabs, and is extensively used in Tripoli and other towns. From the wool of their sheep the women make strong barracans, carpets, shirts, and turbans. Their tents are also made of wool and goats'-hair, and also the sacks which are used in the carrying of corn and merchandise on their camels. Mats and ornaments of palm-leaves or grass are neatly made. Their dyes are generally brilliant, black, blue and orange; in fact every colour except green, which they find much difficulty in producing, though at Tripoli the dyers succeed very well with it. Many of the articles ma by the women are brought to Tripoli and other towns for sale.

The Arabs are divided into numerous tribes. Each tribe, or even set of tents, is governed by a sheikh, who, being an old man, or a young man appointed by government, is looked up to as a superior, though his business is chiefly to collect the money which is to be paid to government. Nearly all the tribes have lately been brought to a complete subjection, though thirty or forty years ago several of them were always in a state of rebellion. In religion the Arabs are great bigots, and very superstitious.

The Jews are numerous in the towns and in the villages of the Arabs. In the towns, though much oppressed, and paying large sums as tribute, they have succeeded in monopolising several branches of commerce. Among the Arabs, where they are much better treated, they apply themselves to several mechanical arts and trades. In Tripoli and the larger towns they have several synagogues.

The Moors are most numerous in the towns and in the Mesheea of Tripoli. They are either landed proprietors or merchants. As merchants they are mostly engaged in the cafilas which go to Fezzan and Bornou. They resemble exactly the Moors of Marocco, but are less instructed than the Moghrebins, having no colleges, though there are several schools in which the children are taught reading and writing. They are less bigoted than the Arabs.

The number of Turks and Mamelukes has increased since the country has again become dependent on Constantinople. They are either officers of government or serve as soldiers. Christians are only found in the town of Tripoli, where they are better treated than in any other place in the Turkish dominions. They are permitted to build churches. The greater part of them are Maltese, but there are natives of Italy. The black slaves, who are mostly kept by the Moors, are nearly all natives of Soodan.

(Horneman's *Journal of Travels from Cairo to Mourzouk*; Tully's *Narrative of a Ten Years' Residence at Tripoli in Africa*; Della Cella's *Narrative of an Expedition from Tripoli in Barbary to the Western Frontier of Egypt*; Lyon's *Narrative of Travels in Northern Africa*; Denham's, Clapperton's, and Oudney's *Narrative of Travels and Discoveries in Northern and Central Africa*; Beechey's *Proceedings of the Expedition to explore the Northern Coasts of Africa from Tripoli eastward*; Pacho's *Relation d'un Voyage dans la Marmarique, la Cyrenaique*, &c.; Ewald's *Reise von Tunis nach Tripolis*.)

Climate.—This part of Africa enjoys a fine climate no less propitious to the produce of the soil than to the health of its inhabitants. About the middle of October the rains begin, and in November the seed is sown. January and February are coldish months, yet the natives make use of no fire to warm themselves, but chase away the morning cold by the beams of the sun, which is never a day without showing itself, and at night they retire early to bed well wrapped up. There are some cold winds in March. In April the fruit begins to form itself, and the air is serene and beautiful. In May the rain generally ceases. August is the hottest month, when the hardy Arab, although inured to the climate, is obliged to retire with his animals from labour for two or three hours in the middle of the day and seek the shade. Rain at this time is rare and dangerous, producing acute fever, and carrying off many of the lower orders. In the summer months ophthalmia is sometimes prevalent. The *scirocco*, or south-east wind, which in Sicily and Malta is extremely humid and enervating, is here exceedingly dry, and although oppressive, from the increased heat of the atmosphere, is considered a healthy wind. The air on the other hand is humid when the easterly and northerly winds prevail. Dr. John Dickson, an English physician, who has resided six and twenty years in Tripoli, from whom we have derived this account of its climate, has likewise favoured us with the following as the results of three years meteorological observations taken in the city:—Thermometer (Fahrenheit) max. 92°, min. 44°, mean temperature 69°; the average number of days in the year of fair weather were 298, and of rain 67; the easterly winds were most prevalent from March to October, and the westerly from November to February; the rain is generally accompanied by a north-westerly wind.

The country is free from plague, unless when brought from other places, as happened in 1785, when it was introduced from Tunis. It has never been known to pass from the side of Egypt by land. But when the pilgrims began to pass to and from Egypt by sea, sanitary regulations were established under the direction of Dr. Dickson, and the plague was four different times confined to the lazzaretto, and prevented from getting into the country. These precautions however being neglected on the change of government in 1835, the next year it was introduced by the pilgrims who arrived by sea from Mecca and Alexandria; and in 1836-37 it carried off from thirty to forty thousand victims in the capital and the populous neighbourhood of the Mesheea, and not less than one hundred thousand in the whole regency.

Government.—The Bashalic of Tripoli, like the other Barbary states, is a sordid despotism; and whether ruled by a Turkish or Moorish chief, is held for the sole purpose of exacting a revenue, without any regard to the well-being of the people or the prosperity of the country. A considerable sum was formerly drawn from the plunder obtained by her corsairs, and a very lucrative branch of it was derived from the traffic in European slaves. But the humane interference and decisive measures of Great Britain in 1815-16 have contributed to abolish these sources of profit, and piracy is no longer heard of. To supply this deficiency, instead of encouraging foreign commerce, the country was burthened with monopolies, the currency was tampered with, and the people were ground down with new taxes. The necessity which the inhabitants of the towns and villages have for a local protector, and the command of the coast by his own vessels, enable the basha, when firmly established, to levy multiplied imposts upon the whole country; nor is it difficult to collect a tribute from the Arab tribes, who periodically visit the Tripoline territory for the purpose of sowing and reaping their crops, which the generous soil so readily produces, or of furnishing themselves with those other supplies which the Desert will not afford them. The distant beys of Bengazi and Derna, holding their office at the pleasure of the basha, make the most of their uncertain tenure by arbitrary exactions for themselves, as well as to enable them to comply with their master's demands; while the sheiks of Barca and Sert pay likewise a tribute, in return for which their power is acknowledged in the Desert. Thus the system throughout is one of extortion; and being carried to its utmost limit by Yussuf, the last Moorish prince, has in its turn destroyed the government of the Moorish dynasty, whose power, a century ago, was raised in a similar manner upon the disaffection caused by the rapacity of the Turk.

History.—The early history of this country will be found under the heads AFRICA, BARBARY, BARCA, CYRENAICA. After the destruction of Carthage it became a Roman province, and the three flourishing cities of Oea, Leptis, and Sabrata constituted a kind of federal union under the name of Tripolis. In the year of the Christian æra 366, it suffered from the tyranny of Count Romanus, who held the military command in Africa under the emperor Valentinian. On the conquest of northern Africa by the Vandals in the fifth century, it passed into the hands of those barbarians, from whom it was rescued in the reign of Justinian, by Belisarius in 534. About a hundred years afterwards, when the first caliphs pushed their hordes of Moslems through Egypt, and were advancing impetuously to the unknown countries of the west, through the desert of Barca, which was considered impervious to a Roman legion, Tripoli was the first to resist the shock; but after an obstinate contest, in which the prefect Gregory was slain, the town was forced to yield. After the Arabian conquerors had consolidated their power in northern Africa, and detached themselves from the caliphs of Egypt, Tripoli was generally governed by the Arabian dynasties settled at Cairoan; but from its nearer vicinity to Egypt it was more liable to inroads from this quarter. It was consequently besieged by the Egyptians in 877 and in 1054. In the next century (1146) it was seized by Roger II., king of Sicily, who held it however but a short time; for in 1184 its walls were razed by Yakub, and it followed the political condition of Tunis, and was subject to its kings. From this time until its conquest, about 1510, by the Spaniards, Tripoli is scarcely mentioned by historical writers. In 1530 the emperor Charles V. ceded it, with the island of Malta, to the Knights of St. John of Jerusalem, after their expulsion from Rhodes. Its only strength was then a castle, which they engaged to keep and to hold in defence of Christendom; but in 1551 it was wrested from them by Simon Basha, sent to the attack by their inveterate enemy the Sultan Solyman, who appointed the famous corsair Dragut (whose forces formed part of the expedition) its first governor; and about this time its present walls were built, and the tract of country now composing the regency was first made a Turkish bashalic. Tripoli now became one of those systematic piratical powers who for centuries attacked the commerce of Christian nations, making slaves of their prisoners. The first treaty between England and Tripoli bears the date of 18th October, 1662. In 1683 the town was bombarded by a French fleet, when the basha sent an humble submission to Louis XIV.; and in 1716 England made another treaty of peace and commerce with Tripoli. Nevertheless the Tripoline cruisers seldom allowed a ship at sea to escape them if they thought they could make a prize of her with impunity; and it was not until 1816 that slavery and piracy were abolished. Previous to the attack in that year on Algiers, a British naval force appeared off Tripoli, and the basha bound himself to treat all prisoners in future according to the usage of European nations.

For the last 300 years Tripoli, like the other Barbary states, has been considered a dependency of the Ottoman Porte; but the allegiance of these states principally arose from the Sultan being the chief of the Mohammedan religion; and being at the same time an acknowledged sovereign, this brought them, by his nominal protection, in some degree within the pale of international law. Yet, as has been seen, they made separate and distinct treaties with other powers, and were so far independent. At first the governors or bashas of Tripoli were sent from Constantinople, supported by a garrison of Turks, who kept the Moors in complete subjection; and being liable to be recalled, they generally purchased the continuance of their appointment by remitting a handsome tribute to the supreme government, and exacting as much as possible for themselves. But in 1713, Hamet Caramanli, a Moorish chief, and second in command, headed a well-concerted rebellion, and was proclaimed basha by the people. At a palace not far from the city he invited all the Turkish officers to a superb entertainment, where about 300 of them were strangled; and in twenty-four hours the Turkish garrison was annihilated. Having in this manner freed himself and his family from the Turkish yoke, and having succeeded in appeasing the Grand Sultan by large presents, he contrived to render the government hereditary in his family, which continued so until very lately, and his reign is still called glorious. In a similar manner Mehemet Ali founded his extraordinary power in Egypt, by the murder of the Mamlooks in 1811. Notwithstanding this total change in the government and dynasty, the supremacy of the Porte was still acknowledged by the payment of an annual tribute, more or less in amount according to the means of the Ottoman government to enforce it. But the power passed into the hands of the Caramanli family, that is to say, of those of Hamet's descendants who had the most influence, or the most cunning or courage, and the best opportunities of putting to death those relatives who stood in their way. At the accession to the bashalic of the third Moorish prince, in 1755, seven of his uncles suffered, and one escaped to Tunis. Tully's 'Letters,' written during a ten years' residence at the court of Tripoli (1783 to 1793), contain a vivid account of this dynasty, as well as of the manners and customs of the place, and of its topography.

In 1832. Yussuf, the last basha of the Caramanli family, who raised himself to power by the murder of his brother, having lost the affection of the Tripolines, after a reign of forty years, owing to the profligacy and expenditure of his government, and its consequent tyranny and oppression, was shut up within the walls of the town by his revolted subjects, and was obliged to abdicate. Hence arose a civil war between two of his descendants, which lasted three years. The Porte at first espoused the cause of the third son, Ali (his two elder brothers being dead), who was in possession of the town of Tripoli; but being unable to force him upon the Arab Sheiks in the country, who had attached themselves to Emhammed, son of the eldest brother, and consequently grandson of the old Basha Yussuf in a direct line, a Turkish force appeared off the port, in 1835, and carrying off Ali by stratagem, established again the old policy of governing the country under a chief appointed from Constantinople. A full and authentic detail of these events may be found in the *United Service Journal* for April and December, 1835. Yussuf, who died in poverty, was friendly to England, from the time that he became aware that the French, in the war of the Revolution, wished to establish a post in the province of Derna in furtherance of their projects on Egypt; and he knew that his authority in that quarter depended upon the retention of Malta by Great Britain. On this account our garrison there and our fleet in the Mediterranean always obtained supplies from Tripoli, during the war, with great readiness. The remains of this family (for Emhammed, unable to survive the ruin, shot himself), consisting of Mohammed Bey and his two sons, are now refugees in Malta (1841), living upon an allowance from the British government. The present Turkish basha of Tripoli, Askar Ali, is powerless beyond the walls of the capital. He has his bey, or lieutenant, at Bengazi, whose power is equally circumscribed to the precincts of that town. Yet the possession of these two ports, the only ports in the regency, in a great measure controls the whole country; but the interior is under no settled rule, and the sultans of Fezzan and Bournou have thrown off their allegiance; while the chiefs of Aujila and Ghadamis are only friendly in so much as the situation of their territories requires an outlet for their commerce. Since the existence of the present anarchy the country is entirely without a master: the latest accounts represent the Turkish basha as being in continual hostilities with the Arab chiefs, who sometimes advance to the very gates of the city. This state of things must last until by a favourable conjuncture some of them be gained over, either by bribery or by sowing dissension and jealousy amongst them, which requires more tact and address than the Turkish basha has yet acquired. As long as they remain united they can easily set him at defiance; while his necessities oblige him to permit a limited trade in those commodities they either want or have to dispose of, which pay a duty, in passing through his capital, and which would otherwise form a contraband traffic on some practicable part of the coast.

Tripoli was the least powerful of the piratical states. Father Pierre Dan, who was sent from Paris on a mission to these countries for the redemption of slaves, says, that formerly Tripoli had as many as twenty-five cruisers, but in 1636, when he wrote his 'Histoire de Barbarie et des Corsaires,' she had only seven or eight, the rest having been lost or taken by the Knights of Malta; and we do not find that she ever afterwards made any great figure at sea. In 1813, under Mourad Rais, a Scotch renegade, who died of the plague in 1837, the Basha's naval force consisted of a frigate and six smaller vessels, and about fourteen gun-boats. In 1830 he had five corvettes and brigs, of from fourteen to twenty-two guns, five smaller vessels of from four to ten guns, and ten gun-boats. Most of these were sold or otherwise disposed of by Yussuf Basha before his abdication, and the rest were sent to Constantinople after the change in the government; so that Tripoli has at present no marine of its own. She never had a standing army beyond the three or four hundred Mamlook guards of the Basha; but the town is now garrisoned by about six hundred Turkish troops.

Antiquities.—Most of the towns in the regency possess interesting remains, which are as yet but imperfectly known, particularly in the Pentapolis, where innumerable chambers are hewn out of the rocky hills throughout, some of them with architectural elevations, sculpture, and inscriptions. The ruins of temples, theatres, and aqueducts of Roman construction are particularly traceable at Ghrenna (Cyrene), Tauchira (Arsinoë), Ptolemeta (Ptolemais), and Marsa Susa (Apollonia). Lebida (Leptis Magna) was examined by Captain Smyth in 1817; but the ruins are so deeply buried in the sand, that plans of them could not be easily obtained. Indeed it seems that this city had been so completely ravaged, that it would not probably repay the labour and expense of a search, everything ornamental being found purposely chipped and defaced, and the massy shafts of the columns only remaining entire, thirty-seven of which were brought to England. From this place also Louis XIV. obtained several granite columns of great size to decorate one of his palaces. A story of an antient petrified city in this part of the world, with its people and animals ...

standing in stone in their natural attitudes, as struck by a superhuman power, was circulated by a Tripoline ambassador in London a century ago, which has ever since stimulated the research of every traveller. Rassem was the name given to this wonderful place. But the tale is now regarded as a fiction created by the fertile imagination of the Arabs, who may have thus described the remains of some antient city with its buildings and statues. In the city of Tripoli stands a fine Roman arch, whose solidity of construction has preserved it from ruin. It was built in the second century; but although the inscription is perfect, the groups of figures which once ornamented it are too much worn away to be made out, and the whole edifice is nearly half-buried beneath the surface of the earth. To this circumstance, and owing to its arches being filled up and used as storehouses, it probably in no slight degree is indebted for its preservation. At Tripoli Vecchia there is an amphitheatre of Roman construction still entire, of 148 feet in diameter, with five degrees of seats; and in the same direction still exists the remnant of one of the great Roman ways, on the borders of which are observable the ruins of antient buildings in stone. Money, coins, and precious stones and gems, mostly intaglios, for which the people of Cyrene were once famed, have been found on the site of the antient Berenice; and at the depth of a foot or two from the surface of the plain near that town fragments of architecture are also commonly found. But a search for antiquities under a Turkish basha, in any part of the regency, would meet with insurmountable obstacles, from the suspicious and jealous nature of the people. Under the former dynasty of Moorish princes our consul had succeeded in a great measure to conquer this prejudice, as was proved by the researches made at Lebida.

Ghadamis.—The oases of Aujilah, Fezzan, and Ghadamis are generally dependent on Tripoli. The first and second have been noticed in their proper alphabetical places. It remains for us therefore to give a short account of the last mentioned. Ghadamis is situated to the south-west of Tripoli, in 30° 40′ N. lat., 10° 25′ E. long., distant from it about fifteen days' journey, and as many from the town of Cabes, in the kingdom of Tunis. Major Laing is the only modern traveller that has visited it; but his papers being lost, little is known of the place, except that the inhabitants, amounting to about six or seven thousand, are a quiet trading people, and seldom take part in the political vicissitudes of Tripoli. Abulfeda says that the town contains the ruins of Roman buildings, which Major Rennell accounts for from its having been a Roman establishment, the Cydamum of Pliny. (*N. H.*, v. 5.) But its importance arises from the four commercial roads which from this point strike into the interior regions of Africa. The first, which we shall call the eastern road, passing through Mezda and Sockna, takes a southern course to Mourzouk, and so on to Bournou and the Lake Tchad, and its neighbouring countries of Kanem and Beghermi; the second, or direct southern road, leads to the city of Ghraat and across the desert of Soudan, passing through Agadez to Houssa and Kasseena; the third, which may be called the south-western road, crossing the Great Desert, and passing through Ainel-Salah and Akabli, in the country of Tuat, leads directly to Timbuctoo, where some of the people of Ghadamis are settled; the fourth is the western road, which, passing to the south of the great chain of Mount Atlas, directs its course towards Marocco by Taffilelt. All these routes may be found traced on Wyld's large map of Africa (1838) from good authority.

TRI'POLI, a city and port of the Mediterranean, on the northern coast of Africa, which gives its name to one of the regencies of Barbary. Its castle is in 32° 53′ 56″ N. lat. and 13° 10 58″ E. long. It is the capital of the state and the residence of the basha. The city is built upon the site of the ancient Oea, which, with the cities of Leptis Magna and Sabrata, formed the province called Tripolis under the Roman emperors; and being the only one of the three which is still an inhabited town, has preserved the name of the district or province.

The town is built upon a rocky promontory which stretches a short distance into the sea, which washes it to the northward on two sides, while the south and west sides are bounded by a sandy plain which is partly cultivated. It is defended by a castle, whose walls are unusually high, and which, being situated at the south-east angle, connects the line of batteries on the sea-front with a high wall that defends the town on the land side, and this is strengthened by six bastions. Altogether these works, including the castle and forts defending the harbour, mount about one hundred pieces of cannon, many of which are of brass. The town has two gates; one towards the sea, the other opening to the south-east on the plain; and it is stated by those who have seen the place and are capable of judging, that it might soon be converted into a strong fortress. At present it is formidable enough against the natives and Arab tribes, but not capable of resisting a well-organised force either by land or by sea. Captain Beechey estimates the extreme length of the town, which is very irregular in shape, to be about 1360 yards, and its breadth about 1000 yards.

Although Tripoli is not so large as Algiers or Tunis, the streets are in general wider and straighter: still they are for the most part more like narrow lanes; and the whole town is so uneven with accumulated rubbish, on which the houses are in fact sometimes built, without regard to a general level, that those who are unaccustomed to the indifference of the Moors and Turks in such matters, might imagine they had wandered to some deserted and ruinous part of the town, when in reality they were traversing its best streets. The houses are built of irregular stones and mud formed into a mass, and whitewashed. They seldom have an upper story, and an aperture is rarely seen in the exterior walls, the rooms being entered and lighted from a spacious square yard in the centre of the building. Tripoli contains six mosques of the first order, with a number of tall minarets, besides many smaller mosques. The exterior of the great mosque, built by the Carumanli family, which stands in the main street, is extremely handsome and majestic; the roof, composed of many small cupolas, is supported upon sixteen Doric marble columns, said to have belonged to a Christian temple. The floor is laid with rich carpets, and the subdued light and richness of the ornaments create an imposing effect. Indeed some travellers have observed that the religious ceremonies in Tripoli are more pompous and striking than in most other Mohammedan countries. The Jews have their synagogues, and the Christians enjoy the free exercise of their religion, a convent of Franciscan friars, with endowments in the country, being under the protection of the Roman Catholic powers. The bazaars are so extensive that Captain Lyon calls them streets covered in overhead: one containing the shops of the traders, which are ranged on each side, and are very small; the other appropriated to slave-dealing. The slaves, who are brought from the interior of Africa by the caffilas, or caravans, as well as other articles of sale, are led or carried about in these bazaars by cryers, who keep up a continual noise, each calling the price of his merchandize. The shops in the town are miserable-looking hovels, although some of them contain articles of value, such as diamonds, pearls, gold ornaments, rich gems, and scarce drugs. These are principally in the hands of the Jews, who have a quarter allotted to themselves, in which they are confined every evening; but notwithstanding this apparent persecution, they engross the greatest part of the trade, and are intrusted with employments of accountability and profit. The Roman arch standing near the sea-gate is noticed afterwards under the head *Antiquities*. Several fondooks, answering to the description of the caravanseras of the East, receive the merchants and their goods from distant parts; and so well did some of the Moorish princes understand the advantages of commerce, that one of them in the last century erected a very large building of this description, where the Moors find a free shelter. The baths make a considerable show by their picturesque clusters of cupolas; some of them are chiefly of marble, and are crowded with bathers. Captain Lyon has given us a very concise and intelligible description of the vapour-bath, and the manner of shampooing of the Eastern nations, as practised in Tripoli, which we do not think has been so well described by any other traveller. As there are no streams near the city, the rain which falls in the winter furnishes the inhabitants with water for the summer, during which not a drop of rain falls for months together. The rain is generally collected from the flat roofs of the houses, and carefully conducted by channels into a reservoir beneath the courtyard, where the water is preserved pure and clear. Water however for common purposes is easily found on the plain near the surface, but it is brackish.

There are a few schools, at which the reading of the Koran and sometimes writing is taught; but the people have no mental pursuits, and a knowledge of letters is by no means useful to advance a man to any post of importance; for the Moors are rarely appointed to offices of honour or profit. They apply themselves principally to commerce, which they usually conduct upon the simple footing of barter, and seldom by prompt money transactions, so that a little arithmetic suffices them. There are however several regular European houses of business, chiefly French, Italian, and Maltese, whose principals, together with the European consuls, form the only educated class of the community. The inhabitants spend their time in the Turkish bazaar, smoking and drinking coffee, and gossiping upon the events of the day. A kind of Italian is generally spoken by the people of the town, in which language Europeans may make themselves understood in transacting their affairs. The basha, whether Moor or Turk, generally confers the offices of state upon some of his own family, or upon foreigners or renegades upon whom he fancies he may depend more securely than upon the leading families of the country; for which reason he is seldom without powerful enemies. Justice is administered and executed for heinous crimes, with great promptitude and little form, so that they are perhaps rarer here than in some European countries: but avarice, deceit, and low cunning are predominant vices of the common people in their dealings; and although they are bigots in their religion, they do not possess the Mussulman virtue of sobriety, wine-shops, which yield a great revenue to the government, being public, and intoxication very common. As no registers are kept, it is difficult to say what may be the population, but it is estimated, since the plague of 1837, at about 20,000, of whom about 2000 are Jews. The Christians are inconsiderable and fluctuating in numbers: they are principally Maltese, who, on account of the vicinity of their island, leave it and return to it, according to the season or the demand for labour in Tripoli. The Maltese may amount to about 1000 or 1200; and when the country is not torn by civil war, they are double that number.

Outside of the town are the burying-places; and as great respect is paid to the dead, the tombs are decent and numerous. The basha has several country palaces, or kiosks, in the surrounding districts, where some of the European consuls and other persons of note also have country-houses and gardens. These plantations, though they have no neat walks, appear like so many groves of orange, citron, and lime trees, which, contrasted with the dark olive and tall date tree, with its immense spreading branches issuing from the top of it one hundred feet high, while the jessamine, geranium, and violet cover the ground, sending forth their rich odours, form altogether a scene amidst this sandy tract totally different from what is met with near the capitals of Europe. Yet, notwithstanding the sandy appearance of the soil, it is very fertile when turned up and worked by the hand of man, the gardens and arable land being in fact an encroachment upon this little desert, which extends almost to the Guhrian Mountains. In peaceable times the wandering Arabs make their appearance towards the autumn in the flat cultivable country near Tripoli, where they sow their corn, and returning in the spring, pitch their tents, and remain until it is fit for reaping. The women in the meantime employ themselves in weaving, and sell their work to the townspeople. But the Arabs cannot enter the town without leave, and their chief is answerable to the basha for their good conduct. There are good weekly markets outside the town, and others at a distance of five and ten miles, well supplied with cattle of all sorts, poultry, game, vegetables, and fruit, the produce of the cultivated districts. The necessaries and even luxuries of life (with the exception of tea, sugar, coffee, and wine) are at hand, and cheap. Fish, taken on the coast by Maltese fishermen, is abundant and good.

The harbour is formed by a long reef of rocks running out from the northern point of the town into the sea in a north-easterly direction, and by other reefs at some distance to the eastward of these, which together form a tolerably good shelter. The western side is protected by the projection of land on which the town stands. In the deepest part however there is not more than five or six fathoms water. Ships of war are consequently obliged to anchor in the outer roads, where there is good holding-ground in sixteen and eighteen fathoms; but the anchorage is exposed to northerly winds. Two batteries, erected on commanding points of the reefs already mentioned, and two others situated on the beach, might annoy the vessels of an enemy entering the harbour; and all these forts are better mounted and in better condition than the defences of the town inland. The mainland, being very low and quite level, presents no conspicuous appearance from a distance, except long lines of date-trees extending for many miles along the coast. On a nearer approach the town appears in a semicircle, and the white square buildings, intermixed with cupolas and minarets, and with Indian fig and date trees growing among them, give to the city at a distance a pleasing appearance.

The foreign commerce is liable to so much variation, from the want of a stable government, that little can be stated on this subject, except that it is decreasing every year. At all times the duties of export and import (which by treaties with most of the Christian powers are 3 per cent. upon all articles *ad valorem*) depend almost entirely upon the will of the reigning basha, or rather upon his necessities; but particularly so in the present state of the country. Commercial treaties in Tripoli are more or less observed, according to the notion more or less imposing of the power of each state, or the probability of remonstrance. The government also reserves to itself certain monopolies of the produce of the country; while other monopolies, both of imports and exports, are farmed out to the Jews, according to circumstances, and to raise money. But the measure most ruinous to trade is the power assumed of coining and fixing the value of a debased currency, which has sometimes been made to lose 15 and 20 per cent. in a week. Arms and warlike stores, and timber, as well as all sorts of grain and pulse, are generally admitted free of duty; and articles for the use and consumption of the Christians established in the regency are similarly privileged.

From the nature of its port the trade of Tripoli is carried on in small vessels, seldom larger than brigs, none of which are now owned in the country; for its commercial, together with its national marine, is nearly annihilated since the attempt of the Ottoman government to force upon the Arab chiefs and people a basha or governor from Constantinople. It has no direct trade with England, but an indirect one through Malta. Marseille, Leghorn, and the commercial towns of the Adriatic and the Levant likewise trade with Tripoli. The imports from Europe are woollen cloths of all sorts, coarse German linens, printed and striped cottons, silk stuffs of various colours and descriptions, common white muslins and calicoes, earthenware, common writing-paper, gold and silver tissues, cottons, cotton twist, beads, common looking-glasses, sword-blades, hardware, and fire-arms of all sorts, gunpowder, shot, lead, tin, tin plates, sugar, coffee, spices, common wines, and spirits. The exports consist of some articles of produce and commodities brought from Central Africa by the caravans, such as morocco leather, wool, hides, goats' and sheep's skins, soda, salt, oil, sal-nitron, madder roots, wax, saffron, senna and other drugs, ostrich feathers, gold-dust, ivory, gum, dates, horned cattle, sheep, poultry, and butter.

In 1827, a short time previous to the fall of the Moorish dynasty, the total imports were estimated at only 524,7[illegible] and the exports at 449,000 Spanish dollars. Among the exports we observe 2000 head of black male and female slaves valued at 140,000 dollars. In former years they amounted to 3000 and 4000 annually. They are brought from Fezzan and Ghadamis, and are generally shipped to Tunis, Egypt and the Turkish ports of the Levant, in vessels of these countries or of Tripoli.

Some idea may be formed of the countries with which this trade was carried on, from the following enumeration of arrivals in the port of Tripoli, from July, 1827, to June, 1828, namely, English vessels (belonging to Malta), 2[illegible]; French, 18; Tuscan, 17; Austrian, 11; Tripoline, 1[illegible]; Sardinian, 8; Sicilian, 5; Ottoman, 5; American, 1; Russian, 1; Dutch, 1; and Tunisine, 1—in all, 102 brigs, schooners, and smaller vessels, without including the Tripoline and Tunisine boats of ten or fifteen tons, which keep up a frequent communication with the island of Gerba, as we as with Bengazi and Derna. Of course the trade of Tripoli must greatly depend upon the communication with the interior; and it profits once or twice a year from the passage of the pilgrims from Western Barbary on their way to Mecca. Formerly these caravans, composed partly of penitents and partly of traders, started from Fez, and passing through Tlemsen, Algiers, and Tunis, increasing as they went, on arriving under the walls of Tripoli amounted sometimes to 3000 persons, and half as many camels and horses, with their goods and merchandize, returning by the same route. But since the general pacification of Europe, and particularly since the suppression of the Greek pirates in the Levant, numbers of devout Moslems prefer the passage by sea to Alexandria, as less fatiguing and less dangerous. This has worked a change for the worse in the traffic of the place, the caravans which stop there in the present day seldom amounting to more than a few hundred people and animals; and this diminution may be ascribed as much to the false views of the late basha Yussuff, in anticipating the duties and profits upon merchandize, and imposing upon commerce other shackles, which threw it into the hands of mercenary speculators, as to the more convenient route chosen by the true penitents. The caffilas therefore, or small caravans from Fezzan and Ghadamis, are now the principal medium of inland trade. These people exchange their merchandize for that of Europe, and pay the balance in gold-dust; and their credit is so good, that the merchants of Tripoli trust them, with few instances of their being deceived. Some very interesting information on the commerce of Tripoli, by the Chevalier Graberg de Hemsö, Swedish consul in that regency, may be found in the *Antologia*, a periodical published at Florence in the years 1828-1830, Nos. 81, 88, and 111, which were but imperfectly noticed at the time in the 'London Magazine,' the 'Révue Britannique,' and the 'Bulletin des Sciences Géographiques.'

Tripoli, from the regard generally entertained for the English nation by the ruling basha, Yussuff Caramanli, in the beginning of the present century, and the good understanding kept up with him by our consul, no less than from the authority of the Moorish princes over the dependent states, and particularly their power in Fezzan, is the only place from which Northern Africa has been explored with any success by our travellers. Thus at the instigation and by the influence of Consul Warrington, Mr. Ritchie and Captain Lyon penetrated as far as Tegerry, the southern extremity of Fezzan, 24° 4′ N. lat., in 1818-19-20. The expedition of the brothers Beechey, around the Gulf of Sidra, and in the Cyrenaica, in 1821-22; the survey of the coast eastward of the town of Tripoli, as far as Derna, in the same years, by Captain Smyth; the discoveries made in the years 1823-24, by Major Denham, Captain Clapperton, and Dr. Oudney, extending across the Great Desert to the tenth degree of northern latitude, and from Kouka in Bournou to Sackatoo, the capital of the Soudan empire—as well as the journey of Major Laing to Timbuctoo, in 1825-26, although he was cruelly murdered, and we are deprived of every account of it by the loss of his papers,—were all made from this point. The influence of Great Britain in fact, and the power of the basha, were then so great, that our consul declared that the road from Tripoli to Bournou was as open to us, and as safe, as that between Edinburgh and London, and so it was found. But the political revolution of 1835, which we have noticed in another place, has put an end to the ameliorations and extension of commerce so justly hoped for by the late Lord Bathurst, under whose auspices, as secretary of state, the above enterprises were chiefly undertaken.

TRIPOLI occurs massive, with a coarse, dull, earthy fracture; it is meagre and rough to the touch, and yields readily to the nail. Colour, various shades of grey, yellow, and red. It imbibes water, which softens it; when burned it becomes white and is hardened; it is very difficult of fusion.

It was first brought from Tripoli in Africa, but has since been found in France, Italy, and Germany. It is employed in polishing metals, marble, glass, &c.

According to the analysis of Haase, it consists of—

Silica	90
Alumina	7
Oxide of Iron	3
	100

TRI′POLIS. [Syria.]

TRIPOLITZA (Τριπολιτζὰ), one of the chief towns in the Morea, is situated in a plain in Arcadia, surrounded by mountains, in which the antient towns of Mantineia, Tegea, and Pallantium formerly stood. The time at which Tripolitza was built is uncertain. It is not mentioned in the Byzantine writers. The name points to its having been formed from a union of three cities; and the current tradition in Greece is, that these cities were Mukhli, Tegea, and Mantineia. Mukhli is said by the Greeks to have been a settlement from Amyclae in Laconia, and it appears in the middle ages to have been one of the chief places in this part of the Morea. It was taken by Mohammed II., in 1458, and it is not improbable that Tripolitza was built soon after this event, when Mukhli declined in importance. The bishop who resides at Tripolitza is still called bishop of Mukhli.

When Colonel Leake visited Tripolitza in the beginning of the present century, the place contained 2500 houses, of which 1000 were Greek. The walls had only been built about sixteen years, and were of paltry construction. There are several remains of antient art in Tripolitza, as the ruins of Tegea have been plundered for the purpose of building the mosques and other edifices.

The plain of Tripolitza bears grass of a very fine quality, but it is nearly of a uniform level, in consequence of which many parts of it are frequently overflowed by the torrents from the surrounding mountains. Some parts indeed are half the year under water. The climate is cold in winter, and the snow often lies very thick upon the plain for many days.

(Leake's *Travels in the Morea*, London, 1830.)

TRIPPEL, ALEXANDER, a sculptor of considerable note, was born at Schaffhausen in Switzerland, in 1747, and, at nine years of age, was sent to a relation in London, where he was put to the trade of a musical-instrument maker; but having a decided inclination for the fine arts, he afterwards accompanied one of his brothers to Copenhagen, and there studied sculpture under Professor Wiedewelt, director of the Academy of Arts in that city. Having so employed eight years in Denmark, he went to Berlin; but being there disappointed in his expectations, returned to Copenhagen, and gained several prize medals. He then visited Paris, where he remained about three years, and distinguished himself by a very fine allegorical group representing Switzerland. In 1777 he went to Rome, where he continued to reside till his death, in 1793, practising his art with great success, and with the reputation of being one of the ablest sculptors of his time, both on account of the noble simplicity displayed in his productions, and the beauty of their execution. He was more particularly successful in bas-reliefs and busts, among which last he executed one of Göthe for the prince of Waldeck, which is spoken of by the poet himself as being in an excellent style. Another of his works is Salomon Gesner's monument at Zürich. A considerable number of his productions are in Russia. Trippel's portrait is prefixed to the 54th volume of the 'Neue Bibliothek der Schönen Wissenschaften.'

(Weinwich, *Kunstner-Lexicon*; *Biographie Universelle*; *Neue Bibliothek*; &c.)

TRIPSU′RUS. [Woodpeckers.]

TRISECTION OF THE ANGLE. In the articles Duplication and Quadrature, we have given a slight outline of the history of two of those remarkable problems the solutions of which at one time engaged the attention of the learned, and have not yet ceased to be the ambition of a certain class of geometrical students. The trisection of the angle is the third problem of this kind.

Before however we proceed to a similar sketch of the attempts which have been made to cut an angle into three equal parts, we may add to the article Quadrature a notice of a recent extension of the decimal places to which the circumference of the circle has been carried. In that article it is seen that the Oxford manuscript carries it to 154 places: in the 'Philosophical Transactions' for 1841, Mr. Rutherford, of the Military Academy at Woolwich, has carried it to 208 places. The figures after 50582 (up to which all the computers agree) are, according to Mr. Rutherford—

23172 53594 08128 48473 78139 20386 33830
21574 73996 00825 93125 91294 01832 80651
744

which confirms the Oxford manuscript up to its last figure exclusive. This problem is now, in its history, a useful test of the power of computation of one century as compared with that of a preceding one: if it ever be carried farther, it will probably be as a mode of showing the additional power derived from some new method.

The difficulty of cutting an angle into three equal parts is entirely of that geometrical nature which has been alluded to in the articles above cited. Euclid, who confines himself to the description of right lines and circles, could not by these only trisect an angle; but a very slight increase of descriptive power granted to pure geometry would overcome the difficulty entirely. In modern analysis there is no more trouble in trisecting an angle than in finding a cube root: the trigonometrical tables solve the question immediately to a certain number of places of decimals, and the calculation of a series and the solution of a cubic equation may be made to serve for any number of places of decimals. In order to show this, let a be the sine of a given angle, and x the sine of its third part: common trigonometry readily gives the equation—

$$3x - 4x^3 = a.$$

Now a can be found from the angle by means of the series for the sine; and the solution of the cubic equation is then easy enough. [INVOLUTION.] The three roots of the cubic equation are respectively the sines of the third part of the given angle, and of 120° and 240° more than that same third part. The cause of the geometrical difficulty is seen in the cubic equation, which, as appears above, is essential to the problem: no root of a cubic equation was ever exhibited by Euclid's geometry alone, unless that cubic equation were algebraically reducible to one of a lower degree, which could be solved without the extraction of cube roots.

The old geometers soon reduced the question to depend upon the following preliminaries. Let A, B, C, D be the sides of a rectangle, and E the diagonal passing through the angles made by B, C, and A, D: also let the angle E A be the one which is to be trisected. Through the point common to B C draw a line F passing through D and A produced, in such a manner that the part between D and A produced is twice E in length. Then it is easily shown that the angle F A is the third part of E A. Through the point C D draw an equilateral hyperbola, of which the asymptotes are A and B. A chord of this hyperbola, set off from C D towards A produced, and equal in length to twice E, will be a parallel to the line F required. Admit then the hyperbola among the curves of geometry, and the difficulty ceases. Again, if with two-thirds of any given line A as a major axis, an hyperbola be described whose asymptotes make an angle of 120°; and if with A as a base, and a point on the branch of the hyperbola adjacent to the single third of A as a vertex, a triangle be described, the larger of the angles adjacent to A will always be double of the smaller. Consequently, one of the external angles will be triple of one of its internal and opposite angles: so that by describing on the straight line A a segment of a circle containing the supplement of any given angle less than 180°, that circle will cut the branch of the hyperbola in a point which, being joined with the further extremity of A, will give an angle equal to the given angle.

Again, if from any point of a circle a straight line be drawn cutting the circle again, and then a diameter produced, in such manner that the portion externally intercepted between the diameter produced and the circle is equal to the radius, the angle formed by that line and the diameter produced is the third part of the angle made by the two radii, of which one passes through the first point of the circle mentioned, and the other is on the diameter which was produced. The construction can be effected by the CONCHOID of Nicomedes, which curve, if granted, gives the means of drawing a straight line of given length between any straight line and a curve, so that when produced it shall pass through a given point.

Either of the curves known by the name of QUADRATRIX may be made to trisect an angle, as obviously may any curve which assigns a straight line equal to a given arc: for a straight line may be easily trisected. The SPIRAL of Archimedes obviously gives another solution. But there is one particular curve known by the name of the *trisectrix*, which, among curves not geometrical, is peculiarly possessed of this property. It is one of the TROCHOIDAL curves having the deferent and epicycle equal, the motion in the latter being direct and equal to one-half of that in the epicycle. Or, add and subtract the radius of a circle from every one of the chords which passes through a point in its circumference, and the result will be a looped curve, which is the one in question. Let A be the point where the branches unite, and A B the axis of the loop describe a circle with A as a centre, and A B as a radius take a point P in the loop, and let A P and B P produced meet the circle in Q and R. Then the arc B R is three times B Q.

Many other modes of trisection have been proposed, some of great geometrical beauty; but the preceding are those to which it is most likely the student will meet with references in his reading. Many false trisections have also been proposed by persons who thought they could conquer the geometrical difficulty. There is not so much to expose in this class of trisections as in the one of quadratures of the circle which corresponds to it. There has never been so much of romance applied to this problem, no explanations of theological points have been made to arise out of it, no mode of converting the heathen asserted to be a necessary consequence, no Number of the Beast taken into the calculation. We shall only notice one false trisection, because it will afford a useful remark. In May, 1830, an Austrian officer announced his having obtained the geometrical solution in the 'United Service Journal,' and various comments appeared in that periodical, running through various months up to March, 1832. In January, 1832, an actual attempt at solution appeared, the work of a British officer then abroad. This at first sight appeared to be a *geometrical* solution; and what is more, it *was* a geometrical solution, and it might have cost a practised mathematician a moment's doubt whether the problem was not actually solved. But, owing to a mistake, a construction was made, which amounted to requiring that two sides of a certain triangle should be together equal to the third, the consequence of which was that the vertex of this triangle was brought down upon the base. Now the *angle to be* trisected was one of the angles at the base of this triangle, or *equal to nothing;* an angle which no geometer would refuse to declare capable of Euclidean division into three equal parts, each of course equal to nothing. Algebra generally furnishes some proof of the absurdity of the conditions of a problem when they contradict one another: but this is not the case with geometry. A latent assumption which restricts the generality of a solution always produces its effect in the former science; whereas in the latter such an assumption might be made part of a demonstration, and produce its consequences, without pointing out that those consequences are not true of the general figure which was drawn. The accurate use of the ruler and compasses will sometimes correct an error of this sort (and would have done so in the instance before us), *but not always:* solutions have been proposed before now which give so nearly the third part of an angle, that ordinary drawing will not serve to detect their falsehood. Any one who imagines he has discovered a geometrical trisection should take care to submit his construction to an algebraical verification; that is, if any person possessing algebra enough to do so should ever be in such a case.

TRISETUM, a genus of plants belonging to the natural order of grasses. It was separated from Avena by Persoon, who has been also followed by Pursh, Lindley, and other botanists. The inflorescence is panicled, the spikelets 2-7-flowered; glumes with a keel, membranous; lower palea with two bristles, and a tender flexuose beard above the middle of its back; scale lanceolate.

T. flavescens, Golden Oat or Yellow Oat-Grass, has the panicle much branched, spreading erect, spikelets 3-flowered, all the florets awned. It is common in Great Britain, especially in rich pastures. This grass does not thrive when cultivated alone. It contains in proportion to its nutritive matter more bitter extractive than other grasses; and on this account is sometimes a desirable grass. Sheep are very fond of it.

T. pubescens, Downy Oat-grass, has a panicle spreading equally on every side; spikelets 3-flowered, shorter than the florets; leaves flat and downy. This grass is a native of Britain. For cultivation it is only a second-rate grass its produce however is good, and it impoverishes the soil but little. By cultivation it loses the downy character of the leaves, which is generally more evident the poorer the soil on which it grows. It grows naturally on poor, dry, chalky soils. The other species of this genus are not cultivated.

TRISMEGISTUS, or the 'Thrice-Great,' was an epithet given to the Egyptian Hermes, who was said to have invented the art of writing, and to have first taught the sciences of astronomy, astrology, &c. There were several works on astrological and philosophical subjects attributed to him, of which an account is given under HERMES.

TRISSI'NO, GIOVANNI GIORGIO, born at Vicenza, of a noble family, in 1478, applied himself to classical literature, studied the Greek language under Chalcondylas, and became also an elegant Latin and Italian writer. At a mature age he proceeded to Rome, where Leo X. took him into his favour, and employed him in several diplomatic missions. He was afterwards employed by Clement VII., who sent him on a mission to Charles V., with whom also Trissino ingratiated himself. Trissino died at Rome in 1550. He wrote:—1, 'Sofonisba,' the first Italian regular tragedy, which however has little merit, and is now forgotten. It was much praised at the time as a novelty, and was performed at Rome with great splendour. 2, 'L'Italia liberata dai Goti,' an epic poem in blank verse relative to the re-conquest of Italy by Belisarius in the reign of Justinian. The poem is weak and dull, and was considered such from its first appearance. 3, 'La Poetica,' a treatise on the poetical art. This is considered as Trissino's best and most elaborate work. 4, 'Ritratti delle bellissime Donne d'Italia.' 5, a comedy, entitled 'I Simillimi,' in imitation of the 'Menæchmi' of Plautus; besides some minor compositions in Italian and Latin. He attempted to introduce new letters into the Italian alphabet, especially to distinguish the two sounds of the *o* and the *e*, and he wrote a letter on the subject to Pope Clement VII., which was published in 1524; but this innovation met with a great and successful opposition. Firenzuola wrote an invective against Trissino's new alphabetical signs. Zeno however attributes to Trissino's suggestion the custom which has since prevailed among the Italians of writing the *v* and the *j* different from the *u* and the *i*, and of introducing the *z* in such words as 'Venezia,' 'grazia,' 'locuzione,' &c., which used to be formerly with a *t*, 'Venetia,' &c.

Trissino was a friend and adviser of his countryman Palladio the architect, to whom he imparted his own classical erudition concerning the works of art of the antients. (Corniani, *I Secoli della Letteratura Italiana*.)

TRISTAN DA CUNHA, a Portuguese naval commander. In 1505 Emmanuel, king of Portugal, nominated Da Cunha viceroy of the Indies, a post which he was prevented by sickness from accepting. After his recovery he was appointed to the command of a fleet of fifteen vessels, of which Alfonso d'Albuquerque's squadron of five, intended to cruise in the Red Sea, formed a part. Da Cunha sailed, in 1506, with his armament from Lisbon, to which he returned in 1508 (?). On leaving Portugal he steered his course southwards till he reached a latitude so high that some of his men perished from the excessive cold. While steering this course he discovered, in lat. 37° 16′ S., the islands which bear his name. His fleet was dispersed by a violent tempest, and the scattered vessels reassembled at Mozambique. Before reaching this settlement Da Cunha had touched at Madagascar, and, attracted by reports which had been spread of great quantities of spices produced in that island, had examined considerable part of its coasts. Not finding the country answer his expectations, he rejoined his fleet at Mozambique and wintered there. In the spring he undertook an expedition against the chief who held Melinda, and chastised the people of Brava for withholding the tribute they had promised to pay to Portugal. The fleet proceeded from the scene of these actions to the island of Socotra, of which it took possession in the name of Portugal. Here Da Cunha and Albuquerque separated: the latter proceeding to the Red Sea, the former to Cochin, where he concerted with Almeida an expedition against Calicut. The enterprise was successful, and Da Cunha returned to Portugal with five ships richly laden. Soon after his arrival he was made a member of the council of state. He does not however appear to have taken any prominent part in public affairs except when he was sent ambassador to Leo X. in 1515.

In 1536 his son Nuno died at sea on his return from India, where he had been superseded in the chief command by Noronha. The new viceroy had refused his predecessor even a passage aboard of a king's vessel. Nuno sailed in a merchantman, but chagrin preyed on his spirits to such an extent that he died before reaching the Cape of Good Hope, and his body was, at his own request, committed to the sea. Tristan da Cunha expressed his keen sense of the indignities offered to his son by demanding an audience of the king; and on its being granted, appearing, followed by his grandchildren to offer payment for the cannon-balls which had been attached to his son's body in order to sink it. This is the last we hear of him: he appears to have died soon after. An account of Tristan da Cunha's expedition was compiled from his MSS. by De Barros, and published by order of the king. A translation of this narrative was published at Leyden, by Pieter van der Aa, in 1706.

TRISTAN DA CUNHA, a group of islands in the Southern Atlantic, south-south-east of St. Helena, and east-south-east of the Cape of Good Hope. The largest and central island is intersected by the parallel 37° 6′ N., and by the meridian 12° 2′ W. The islands are three in number: the largest, to which the name of Tristan da Cunha properly belongs, is between 19 and 20 miles in circumference; of the two smaller, that which is named Nightingale Island is to the south of the principal island, and that named Inaccessible Island to the south-west. The two smaller islands, from the steep and craggy nature of their shores, can only be approached in a calm. The north side of the largest island is very striking: an extensive plain stretches along the base of a mountain, the sides of which are clothed with thick brushwood, and which towers abruptly to the height of 8326 feet. In 1816 a company of artillery was stationed on this island: it was withdrawn after the death of Napoleon, and a corporal of the name of Glass was left with one or two companions to take charge of the fort and the landing-places. In 1829 the little colony amounted to twenty-seven persons—seven men, six women, and fourteen children. They had 300 acres of land in tillage and extensive pastures. They had 70 head of cattle, 100 sheep (of which the wool found a market at the Cape); a great number of swine and goats, which roamed about wild; and a considerable quantity of poultry. Water is good and abundant in the island, and vessels which touch there can easily procure supplies of fresh provisions. Off the coast is great abundance of seals, and whales, both black and white. These islands were discovered in 1506, by the fleet under Tristan da Cunha, whose name has been given to them.

TRI'TICUM, the genus of plants yielding the various kinds of wheat. It derives its name, according to Varro, from *tritum*, ground or rubbed, because the fruit in its preparation as a food for man undergoes the process of grinding or trituration. The various kinds of wheat have been known from a very early period, and mention is made of wheat as a food in the earliest records of the history of man. Both the Egyptians and Jews made use of wheat as an article of diet, and this food is early mentioned in the Bible. It was also used by the Greeks and Romans, and Theophrastus and Pliny make frequent mention of it. On account of the early cultivation of many of the kinds of wheat as articles of diet, it is impossible to tell where the most common species are really indigenous. All the species of Triticum are however found most abundantly in temperate climates, and there take the place of the foods used in the hotter parts of the world. Wheat is in northern climates what rice and maize are in warmer ones. The part of the plant of Triticum which yields so large a proportion of the food of man is the fruit, seeds, or grain. This fruit, although small in itself, generally forms a large proportion of the plant. When the fruit is ground, the testa, or seed-coat, is separated from what is called the flour. This flour consists of the powdered albumen and embryo of the seed. The proximate vegetable principles which this flour contains are starch and gluten. The starch is a highly carbonised vegetable principle, whilst the gluten is characterised by possessing nitrogen. Foods that contain carbonaceous matters are fattening, whilst those that contain nitrogen are strengthening. It is thus that wheat flour has become to be the staple article of diet of the finest races of men in the world. The other cereal grasses contain the same principles, but the gluten or azotised principle is not in so large a quantity as in wheat, as the following analysis of 100 parts of the organic matter of wheat, rice, and barley will show:—

	Starch.	Gluten.
Wheat . .	70·00	23·00
Rice . . .	85·07	3·60
Barley . .	79·00	6·00

The starch is often separated from the gluten and used for various purposes in domestic economy. [STARCH.] The gluten is also separated, and, in the form of macaroni and vermicelli, constitutes a favourite diet with some nations, especially where little animal food is consumed, for which it is a direct substitute, from the identity of its composition. The following analysis of gluten by Boussingault, and ox muscle, or beef, by Playfair, will make this evident:—

	Carbon.	Hydrogen.	Nitrogen.	Oxygen.
Gluten . .	54·20	7·50	14·00	24·40
Ox-flesh .	54·12	7·89	15·71	21·56

These analyses do not differ more than the analyses of the same substances frequently differ from each other.

The straw of wheat, and the chaff, or the culm, and the flowers, also contain 79 per cent. of organic matter. This consists principally of unazotised vegetable matter, and may therefore be used as an article of diet for cattle. The culms of wheat are also used for the purpose of making plait from which straw hats and bonnets are made, a manufacture of considerable importance in some parts of this country.

The genus Triticum is known by possessing solitary spikelets, with the glumes 2-valved and many-flowered, the valves carinate, acute, or mucronate; the paleæ 2-valved, the valves lanceolate, the external one acuminate, the internal one bifid at the extremity. The genus consists of about 40 species; of these 16 are European, and only 5 are natives of Britain. The species are divided into two groups, the *cerealia*, yielding edible fruits, and the *agropyra*, which are merely grasses. The latter group is by some writers, as Beauvois and Lindley, made into a distinct genus. It includes all the species that are natives of Great Britain.

The Cerealia are known by their spikelets being more or less ventricose and turgid, and the valves are ovate or oblong. These are again divided into the *Frumenta*, or true wheats, in which the seeds fall out from the chaff, and the *Speltæ*, or spelts, in which the seeds remain attached to the chaff. The most important species belonging to the former division are the following:—

T. vulgare, Common Wheat, has a four-cornered imbricated spike with four flowered spikelets, the valves ventricose, ovate, truncate, mucronate, compressed under the apex, the nerve somewhat prominent. This species includes the *T. æstivum* and *T. hybernum* of many botanists. They appear however to be only varieties of this species, differing in their periods of growth. The native country of this species is not well ascertained: it has been found wild in some districts of Persia, also of Siberia, apparently removed from the influence of cultivation. The great extent to which the cultivation of this species has been carried in Europe has produced many varieties. Metzger, in his 'Getreide-Arten,' describes eighteen varieties which are cultivated in Germany; and many more might be added to this list. The variety called *T. æstivum*, is the type of all the wheats which are called summer and spring wheats. These wheats are not much cultivated in Great Britain; they are however in some parts of Germany. Metzger recommends the white-beard summer wheat to be grown on poor lands, as it yields the best straw for plaiting, which is used extensively in Italy for this purpose. The *T. hybernum* is the Lammas or winter wheat, and embraces by far the greater number of varieties which are cultivated as the food of man. The wheats known in Great Britain and on the Continent as Fox, Kentish, Talavera, Bohemian or velvet, red, white, and red-eared bearded wheats are varieties of *T. hybernum*.

T. turgidum, turgid, cone, or English Wheat, is known principally by its prominent carinæ. About ten varieties of this species are known to agriculturists, half of which are summer and half winter wheats. Of these the clock, great or Revel wheat, and the Russian or blue English wheat, are the best.

T. durum, true beard Wheat, has the prominent carinæ of the last wheat, with the valves ventricose, oblong, and three times longer than broad. It is a native of Switzerland. It has several varieties, all of which produce summer wheats, and are better known in Italy, Sicily, and Spain than in this country.

T. polonicum, Polish Wheat, has the spike irregular, four-cornered or compressed; the spikelets 3-flowered, the valves subventricose, oblongo-lanceolate, herbaceous, with many nerves. It is found native in some parts of Europe, not however in the country which gives it its name. In cultivation it yields summer wheats, which are adapted to warmer climates than Great Britain.

The *Spelts* include the following species:—

T. spelta, Spelt Wheat, has a parallel compressed spike loosely imbricated; a fragile rachis, spikelets 4-flowered, the valves obliquely truncated, dentato-mucronate, the carinæ compressed, strongly prominent above, with the tooth of the apex inflexed. All the species of Spelts are cultivated extensively in Germany, and there is so strong a prejudice in their favour in the markets of the south of Germany, that other kinds of corn can with difficulty be got rid of. Their great advantage appears to be, that they accommodate themselves to almost any kind of soil yielding good crops in the extremes of heaviness and lightness, moistness and dryness. They possess a firm stiff straw which is not easily laid, and are not attacked by birds, and are less liable to smut.

T. dicoccum, Two-grained or Rice-Wheat, has the spike oppositely compressed, rachis fragile, the spikelets 4-flowered, the valves obliquely truncated, dentato-mucronate, the carina compressed, strongly prominent above, with the tooth of the apex inflexed. This is the *T. amyleum* of some authors, and is cultivated with the other spelts in Germany.

T. monococcum, One-grained Wheat, has 3-flowered spikelets; the valves at the apex 2-toothed, with straight acute teeth at the apex of the carina. This species is frequently cultivated in Switzerland, and is used especially for making gruel. The spikelets are placed close together, and the spike has a remarkably neat appearance, as if cut in ivory.

The *Agropyra* do not possess ventricose-turgid spikelets, and the valves are lanceolate or linear-oblong. This division includes the wheat-grasses, some of which are commonly known as troublesome weeds. The most remarkable instance of this is the *T. repens*, Creeping Wheat-Grass, Couch-grass, or Spear-grass, which has a distichous spike with 5-flowered spikelets, the valves lanceolate, acuminate, with five nerves, the leaves flat, and underground creeping stem. It is a native of Great Britain and throughout Europe, and is too well known in cornfields. The difficulty of getting rid of its creeping underground stem, the smallest portion of which, if left in the ground, sends up a fresh plant, is the cause of this plant being so great a pest to the farmer. These stems contain a good deal of nutritious matter, and are eaten by cattle, and in times of scarcity some countries have been made into bread by the poor people. The *T. maritimum* of some writers, which is a native of sea-coasts, seems to be only a variety of this plant.

T. junceum, Sea Rushy Wheat-grass, has the spike distichous, spikelets 5-8-flowered, remote, the valves linear-lanceolate, 9-11-nerved, leaves velvety above, the rachis glabrous, underground stem creeping. This is a frequent plant on our sandy sea-shores, and with the Carex arenaria, Elymus arenarius, and Festuca rubra, is one of the plants that binds the sands. Under the influence of the stems and roots of these plants whole districts are rendered cultivable which would otherwise be a mass of barren moving sand.

T. caninum, bearded Wheat-grass, has a distichous spike; 5-flowered spikelets, lanceolate, acuminate, 3-nerved valves; awned florets, scabrous flat leaves, fibrous roots. It is a common plant in England. According to Mr. Sinclair its produce of nutritive matter is good, yields a very early crop when cultivated, and is recommended to be grown on soils of an inferior quality, instead of rye-grass.

T. cristatum, Crested Wheat-grass, has elliptical, ulate, keeled, awned valves scarcely nerved, the spikes much crowded, with about four awned flowers in each. It is a native of Britain, and yields much nutritive matter. On this account it is recommended by Mr. Sinclair as a good early grass for heath soils.

For the best and most practical information on the genus Triticum, consult Metzger, *Die Getreide-arten*.

Wiesengräser in Botanischer und ökonomischer Hinsicht, 1841. The other works consulted have been Koch's *Flora Germanica; Cyclopædia of Plants;* Sinclair's *Hortus Woburnensis;* Pouchet, *Traité de Botanique.*

TRITON. (Zoology.) [SIPHONOSTOMATA, vol. xxii., p. 53.] The term *Triton* is also applied by Laurenti and others as a generic name for the *Aquatic Salamanders.* [SALAMANDRIDÆ.]

TRIT'ONIA, Cuvier's name for a genus of NUDIBRANCHIATA (vol. xvi., p. 362). This generic appellation comes too near to TRITON, already used in a double sense.

TRITONOI'DEA, Mr. Swainson's name for a genus of *Buccininæ*, the fifth subfamily of his *Muricidæ.*

Generic Character.—Shell bucciniform, but the basal half is narrowed, and the middle more or less ventricose; spire and aperture equal. Pillar at the base with two or three obtuse and very transverse plaits, not well defined; outer lip internally crenated, and with a superior siphon; inner lip wanting or rudimentary.

Example, *Turbinoidea undulosa*, 'Enc. Méth.,' 422, f. 5, &c.

Mr. Swainson, who refers to many more species figured in the *Encyclopédie Méthodique*, states that Mr. Gray has the merit of first publishing this intricate, but most natural genus, which he (Mr. S.) had many years ago also determined.

He adds that he should gladly have adopted Mr. Gray's name, were it not that *Pollio* had already been applied to a genus of lepidopterous insects. Mr. Swainson further observes, that Mr. Gray has very happily determined what is certainly its true station in the natural system—that is, intermediate between *Triton* and *Buccinum.* We must remark that the termination used by Mr. Swainson is objected to by many naturalists when employed for a generic name.

TRIUMPH (Triumphus) is in general a solemn procession for the purpose of celebrating a victory. Such processions and solemnities have been customary in all warlike nations, but they have never formed so prominent a feature in the history of a people as among the Romans. In a Roman triumph, the general who had gained a victory of sufficient importance to entitle him to this honour, entered the city of Rome in a chariot drawn by four horses; he was preceded by the captives and spoils, and followed by his army. The whole train passed along the Via Sacra up to the Capitol, where the general sacrificed a bull to Jupiter. Such a triumph was the highest honour that a military commander could look for; it was granted by the senate after any victory either by sea or by land, provided it was thought sufficiently important to deserve it.

When a general had gained a victory or had accomplished the object of his mission, he sent in a report to the senate, which then usually decreed a public thanksgiving (supplicatio). The general returned to Rome, either with his army, or appointed a time when it was to meet him there; but he did not enter the city, and a meeting of the senate was held outside the walls, usually in the temple of Bellona, for the purpose of examining the general's claims to a triumph. The principal conditions upon which a triumph was granted, and which were established partly by custom, and partly by law, are as follows:—1. That the general should have held one of the great offices of the republic, that is, the dictatorship, consulship, or praetorship. 2. That he should have been invested with one of these offices at the time when he gained the victory, and that it should not have expired on the day of the triumph. This regulation however was set aside at an early period, and in cases where the term of office had expired the senate used to grant a '*prorogatio imperii*,' that is, a prolongation of his imperium or authority as general, for the day of the triumph. 3. That the victory should have been gained under the auspices and with the troops of the general who claimed a triumph. 4. That the advantages gained by the victory and the number of the enemies slain should come up to the amount prescribed by law. 5. That the victory should have been gained over a foreign enemy, and not in a civil war. 6. That the dominion of the Roman people should have been extended by the victory, and that it should not be a mere reparation of losses previously sustained. 7. That the war should be actually concluded by it, so as to enable the army to quit the enemy's country.

These rules however were not always strictly observed, and various deviations from them are recorded. Even the sanction of the senate ceased to be thought necessary as early as the fifth century before Christ, and the people in the Comitia Tributa assumed the right to grant triumphs (Liv., iii. 63; Dionys., xi. 50); and there are instances of generals triumphing in defiance of the senate and the people. In later times a general to whom a triumph in the city was refused, used to celebrate it on the Alban Mount. (Liv., xlii. 21.) If however the senate granted it, a sum of money was voted as a contribution towards defraying the expenses of the triumph, and the general was for the day of his triumph invested with the Imperium in the city. During the triumphal procession, the general, standing in his chariot, wore a purple toga embroidered with gold; his brow was adorned with a wreath of bay (laurus), and in his hand he carried a sceptre with the Roman eagle. On reaching the temple of Jupiter he deposited his wreath in the lap of the god. Banquets and other entertainments concluded the solemnity, which was generally brought to a close in one day, though in later times we meet with instances in which it lasted for three days. (Liv., xxxix. 52.)

During the time of the empire, the emperor himself, being the chief general of all the armies, was the only person that could claim a triumph, and it was rarely if ever granted to any one else but a member of the imperial family. Other generals received other compensations. All the triumphs that had been celebrated at Rome were carefully recorded in the Fasti triumphales, and their total number, from the earliest times down to the last, that of Belisarius over the Vandals, has been calculated to amount to 350.

A lesser kind of triumph was called *ovatio*, perhaps from 'ovis,' a sheep, which the general offered to Jupiter, instead of a bull. It was granted after victories which were not of sufficient importance to deserve the solemn triumph. The principal difference between the two was that in an ovation the general entered the city on foot, and in later times on horseback; he wore only the toga prætexta, and his brow was adorned with a wreath of myrtle. He carried no sceptre, and was frequently not accompanied by his army.

(O. Panvinius, *De Triumpho*, in Graevius, *Thesaurus Antiq. Rom.*, vol. ix.; *Dictionary of Greek and Rom. Ant.*, under 'Triumphus' and 'Ovatio.')

TRIUMPHAL COLUMN. [TRAJAN'S COLUMN.]

TRIU'MVIRI, or TRE'SVIRI, that is, 'three men.' A great number of offices at Rome, both ordinary and extraordinary (commissions) were held by three persons in conjunction, who thus formed a board which was intrusted with the management or administration of certain things. The office itself was called triumvirate (triumviratus). Extraordinary triumviri were appointed on various occasions and emergencies; for example, when a new colony was to be founded, the whole management of the business, together with the distribution of lands among the colonists, was usually intrusted to triumviri, whose full title was 'triumviri coloniae deducendae,' or 'agro dividundo.'

The triumvirate which has acquired the greatest celebrity in the history of Rome is that which was established towards the end of the republic by Octavianus, Antonius, and Lepidus. After the republic had been for years distracted by a series of civil wars, the three men mentioned above met near Mutina, in B.C. 43, and assumed, under the title of 'triumviri rei publicae constituendae,' the supreme power for five years, under the pretext of settling the affairs of the state. Their power and its duration was sanctioned by a senatus consultum. They so distributed the administration of the state among themselves, that Antonius received the greater part of Gaul; Lepidus, Spain and a small portion of Gaul; and Octavianus, Africa, together with the islands of Sicily and Sardinia. Lepidus was to govern Rome and Italy, while he exercised his power in Spain by proxy. His two colleagues endeavoured to get rid of the republican party by proscriptions, in which 2000 equites and 300 senators are said to have been put to death. Whole towns were robbed of their property, and their lands distributed among the veteran soldiers of the triumvirs, and hosts of people flocked around the standards of Brutus and other republican leaders, to escape an ignominious death. Consuls were elected during this period as before, but they were either the creatures and friends of the triumvirs, or one of the triumvirs himself held the consulship. In B.C. 38 the time of their office expired, and it was renewed for five years more without any opposition. About the end of this second term the secret enmity among the triumvirs burst out into open hostilities; a new civil war began, which ended in the destruction of republican freedom. The triumvirate of Octavianus, Antonius, and Lepidus is usually called the second triumvirate. The first triumvirate, if we may call it so, was merely a private coalition, or, as it is called in Livy's 'Epitome' (103), a conspiracy, entered into by Cæsar, Pompeius, and Crassus, in B.C. 60: the title triumviri was perhaps never borne by them; it was certainly not recognised either by the senate or the people.

The triumviri who were regular magistrates belonged to the minor magistrates. Among them we shall mention, 1, The triumviri Capitales, who were instituted about the year B.C. 292, and were in many respects the successors of the quaestores parricidii. They inquired into capital offences, apprehended criminals and committed them to prison, wherever they discovered them, and also carried into effect the sentence passed upon them. 2, The triumviri Monetales, or the inspectors of the mint. 3, The triumviri Nocturni, whose duty it was to superintend the watchmen in the city at night, and to prevent or put out fires in the city.

For further particulars about these and some other minor officers of this name, see *Dictionary of Greek and Rom. Ant.*, under 'Triumvir.'

TRIVENTO. [SANNIO.]

TRIVET, NICOLAS, whose sirname is otherwise found Tryvet, Trevet, Treveth, Trevech (a misprint or mistranscription), Triveth, Thriveth, and is latinized Trivetus, Trivettus, Trevetus, and, by Leland, Tripus (at least he has Tripodis in the genitive), was born in Norfolk about the year 1258, and was son of Sir Thomas Trivet, who is recorded to have twice ridden as one of the Justices in Eyre in the latter part of the reign of Henry III. Trivet mentions his father in his Annals, under the year 1272, by the name of Thomas Treveth. He himself was sent, when a boy, to be brought up in the Dominican convent at London, and in due time he became a monk of that order. Having completed his education at the universities of Oxford and Paris (his residence for some time at which latter place of study he notices in the beginning of his Annals), he was, on his return to England with the highest reputation in all the branches of learning then cultivated, elected head or prior of the religious house in which he had spent his earliest years. This office he appears to have held till his death in 1328.

Leland, Bale, and Pits give long lists of the writings of Trivet, especially Pits, whose catalogue extends to between thirty and forty articles. Among them are annotations or commentaries on various parts of the Scriptures, on certain of the works of St. Augustin, on the 'Problems' of Aristotle, the 'Metamorphoses' of Ovid, the 'Tragedies' of Seneca, on Boethius, Livy, and Juvenal, some astronomical and other scientific treatises, and a number of tracts on religious and moral subjects, all in Latin. Many of these manuscripts still exist in the libraries at Oxford and Cambridge, and elsewhere. A commentary on the treatise of St. Augustin entitled 'De Civitate Dei,' by Trivet and Thomas Valois, or Walleis, was printed by Schöffer, in the second volume of his edition of St. Augustin's works, fol., Mainz, 1473, and again at Toulouse in 1488, at Venice in 1489, and at Friburg in 1494. But Trivet is now only remembered for his Chronicle or History, principally of English affairs, though it embraces a sketch of those of the other kingdoms of Europe, from A.D. 1136 to 1307, or from the beginning of the reign of Stephen to the end of that of Edward I. This work was first printed by Lucas Acherius (Father Luc d'Achéry), in the eighth volume of his 'Spicilegium Veterum aliquot Scriptorum,' 4to., Paris, 1671; and it is also contained in the second edition of that collection, in 3 vols. fol., Paris, 1723. But the edition commonly used is that published by Antony Hall, under the title of 'Nicolai Triveti Dominicani Annales Sex Regum Angliae,' at Oxford in 1719, in 2 vols. 8vo., the second of which however (not published till 1721) is occupied with the Chronicles of Adamus Murimuthensis and his Continuator. This edition is from a better manuscript than that which D'Achery used; but otherwise it has no great reputation, any more than Hall's other publications. Trivet however deserves to be well edited; he is a cl painstaking, and exact recorder of events, and he is original authority for many particulars relating to his times, his accounts of which have sometimes been pillag without acknowledgment by subsequent compilers. H Annals have different titles in the various manuscrip and there is also in the library of Magdalen College, O ford, the manuscript of another historical work of hi French, entitled 'Les Cronycles ke Frere Nichole Tr escrit à Dame Marie la file moun seygnour le roy Edw le fils Henry.' Of this the first part is an abridgment the history of the Old and New Testaments; the sec part, entitled 'Les Gestes des Apostoiles (that is, t popes), Emperours, et Roys,' appears to be, in the lat portion of it, nearly a translation of his Latin Annals.

TRI'VIA. (Zoology.) [CYPRÆIDÆ, vol., viii., p. 256.

TRIVU'LZIO, a Milanese patrician family, seve members of which figured in the history of their coun in civil and military capacities under the dukes Visc and Sforza. After the death of Filippo Maria Viscon A.D. 1447, the Milanese having proclaimed a repub Erasmo Trivulzio and several of his brothers were am the most strenuous supporters of the popular cause aga Francesco Sforza, who aspired to the ducal throne. Sfor having succeeded in taking possession of Milan, not o forgave Erasmo, but appointed both him and his neph Antonio Trivulzio to the rank of ducal councillors. T sons of Antonio distinguished themselves in the next generation: one of them, Renato, commanded the troops Ludovico Sforza against the Venetians and the Gris and defeated the latter in Valtellina, for which he w surnamed Helveticus. During the French invasion, remained faithful to his prince: he died at Pavia in 14 His brother Gian Giaccomo Trivulzio, who has been sty by some writers 'il Magno,' or 'the Great,' was born 1441. After serving in his youth under Francesco Sfor and his son Galeazzo Maria, he was appointed on the de of the latter member of the regency during the minority the young duke Giovanni Galeazzo. But Ludovico Sfor the duke's uncle, having assumed the supreme power 1479, Trivulzio was employed by him in the army, and w sent to assist King Ferdinand of Naples against his revol barons. Ferdinand out of gratitude made him count Belcastro. Trivulzio was also employed by Pope Innoce VIII. to reduce the town of Osimo, in the March Ancona. On his return to Milan he found him- slighted by Ludovico Sforza and his courtiers, who mistrusted him on account of his firmness and pride; and fr that time he vowed revenge against Ludovico. He turned to Naples and entered the service of Ferdina When Charles VIII. of France invaded Naples and dr away the Aragonese dynasty, Trivulzio took service w the French at the time when Ludovico Sforza, in conc with the other Italian states, was fighting against them He fought bravely for Charles VIII. at the battle of Taro against the Italian allies. He then followed Charle in his retreat to France. During the negotiations wh were entered into about that time to settle amicably affairs of Italy, Trivulzio supported at first the claims the youthful duke Giovanni Maria Sforza to the crown Milan, but the French insisting upon the rival claims the duke of Orleans, afterwards Louis XII., Trivulzio ga way, and from that time he seemed to have renounced country and to have become altogether French. He w made by Charles VIII., Count of Pezénas in Langue and decorated with the order of St. Michel. In Louis XII. gave him the command of his army in Italy. vulzio defeated the troops of Ludovico Sforza, and ente Milan at the head of the French invading army, in S tember of the same year. Louis XII. then made marshal of France, marquis of Vigevano and Mel Lombardy, and captain-general of the duchy of Mila When Ludovico Sforza again advanced towards Milan the head of his Swiss auxiliaries, Trivulzio being ba supported by the French officers, who were jealous of for being a foreigner, was obliged to leave the city, but h soon after defeated Ludovico at the battle of Novara April, 1500. Ludovico was seized in disguise and tak prisoner before Trivulzio, who treated him ungenerou and upbraided him with reproaches. Ludovico was se prisoner to France. Trivulzio again took possession Milan, but he did not long retain the command of t duchy, which was given to the Cardinal of Rohan. I

1509, war having broken out again in Italy, Trivulzio was employed in the French armies, and commanded the advanced-guard at the battle of Agnadello, in which the Venetians were defeated.

In 1511 the French Marshal Chaumont having died, Trivulzio succeeded him pro tempore as commander-in-chief of the French, and he drove Pope Julius II. from Bologna. Soon after Gaston de Foix, duke of Némours, came to take the command of the French in Italy, and Trivulzio served under him in the campaign of 1512 against the pope, the Venetians, and the Spaniards. After the battle of Ravenna and the death of Gaston de Foix, Trivulzio was obliged to evacuate Milan, which was entered by Maximilian Sforza; and in the following year the loss of the battle of Novara again drove the French and Trivulzio with them out of Italy. In 1515 Francis I., who had succeeded Louis XII., put Marshal Trivulzio at the head of a French army for the conquest of Italy. Trivulzio made a brilliant campaign. He crossed the Alps by a new pass, entered the marquisate of Saluzzo, defeated and took prisoner Prospero Colonna, won the battle of Marignano, called 'the battle of the giants,' against the Swiss, and in a short time conquered the whole duchy of Milan. The Constable de Bourbon was appointed governor, but being recalled in the following year, he was succeeded by Marshal Lautrec, whilst the veteran Trivulzio was living in splendid repose in his own patrimonial house at Milan, and enjoyed great consideration. Lautrec was harsh and suspicious: he oppressed the people of Milan; and Trivulzio having shown some sympathy for his townsmen, Lautrec accused him of secret practices against King Francis. Trivulzio, being informed of this, set out for France in the depth of winter, although he was then nearly seventy-eight years old, and repaired to the court of Francis I., who refused him an audience. He then placed himself in the king's passage, and as the king drew near he begged him to listen to a man who had fought eighteen battles in his service and in the service of his predecessors. Francis stared at him, and passed on without saying a word. This was too much for the old man; he fell ill, and died at Chartres, in December, 1518. His tomb and those of his two wives are seen in the church of St. Nazario at Milan, with this epitaph:—'J. J. Trivultius, Antonii filius, qui nunquam quievit hic quiescit. Tace.' His name is not in favour among the Italians for having served foreigners against his own countrymen, of which however he is no singular instance in the history of Italy. (Litta, *Famiglie celebri Italiane;* Rosmini, *Vita di Gian Giacomo Trivulzio detto il Magno.*)

A branch of the Trivulzio family, enjoying considerable property and the title of marquis, has continued to exist at Milan to the present day. The late marquis, Gian Jacopo Trivulzio, who died at Milan in 1827, was a great patron of learning. From the MSS. of his rich library at Milan he edited or caused to be edited several important works, such as the 'Johannidos, seu de Bellis Libycis,' a poem of Cresconius Corippus; the 'Lettere ed altre Prose del Tasso,' the 'Lettere inedite di A. Caro,' the 'Convito' of Dante, and the 'Life of Gian Giacomo Trivulzio,' already mentioned. The 'baton,' or French marshal's staff, of old Trivulzio is still preserved among the heir-looms of the family.

(Tipaldo, *Biografia degli Italiani Illustri;* Valéry, *Voyages en Italie.*)

TROAD. [Troy.]

TROCHAIC VERSE, a kind of verse used by the Greek and Latin poets, especially by the tragedians and comedians. The foot from which it takes its name and of which it principally consists is the trochee (– ⏑), which is combined, like the iambus and anapæst, into *metres* of two feet each. The most common form of the Trochaic verse is that which is composed of a perfect dimeter followed by a dimeter wanting the last half-foot. This form of verse is the 'Trochaic Tetrameter Catalectic' of the Greeks, which was also called by the Romans *quadratus*, from its containing four metres, and *septenarius*, from its containing seven complete feet. The following is an example in English:

Alexánder háted thinking,
  Dránk aroúnd the coúncil bóard,
Hé subdúed the wórld by drínking,
  Móre than by' his cónquering swórd.

In the Greek tragedians the following are admitted as variations on the pure Trochaic verse:—

1. The syllable at the end of the line may be short, since its time is filled up to that of a long syllable by the slight pause which occurs in that place.

2. The trochee may be resolved into a tribrach (⏑ ⏑ ⏑) in any place; but the final long syllable may not be resolved into two short ones.

3. A spondee (– –) may be substituted for the trochee in the second place of each metre, that is, the *even* places of the verse (2nd, 4th, and 6th).

4. The spondee may be resolved into an anapæst (⏑ ⏑ –). But

5. If there is a tribrach in the seventh place, neither a spondee nor an anapæst is allowed in the sixth.

6. A dactyl (– ⏑ ⏑) is allowed, but only in a *proper name*, in any place.

The following table represents the different forms of the verse:—

1.	2.	3.	4.	5.	6.	7.	8.
– ⏑	– ⏑	– ⏑	– ⏑	– ⏑	– ⏑	– ⏑	⏓
⏑ ⏑ ⏑	⏑ ⏑ ⏑	⏑ ⏑ ⏑	⏑ ⏑ ⏑	⏑ ⏑ ⏑	⏑ ⏑ ⏑	⏑ ⏑ ⏑	
	– –		– –		– –		
	⏑ ⏑ –		⏑ ⏑ –		⏑ ⏑ –		
P.N. – ⏑ ⏑	– ⏑ ⏑	– ⏑ ⏑	– ⏑ ⏑	– ⏑ ⏑	– ⏑ ⏑	– ⏑ ⏑	

The first dimeter ought to end at the end of a word. Often also each metre, and sometimes each foot, ends at the end of a word. If the first metre ends with a word after which there is a slight pause or break in the sense, then the second foot of the first metre is a trochee or tribrach, not a spondee or anapæst. The same restriction applies to the sixth foot when it ends with a word followed by a slight break in the sense. These niceties of structure are exemplified in the following lines:—

Phœn. 636. Ὡς ἄτιμος, | οἰκτρὰ πάσχων, ἐξελαύνομαι χθονός.
—— 646. Ἐλπίδες δ᾽οὔπω καθεύδουσ᾽ αἷς πέποιθα | σὺν θεοῖς.

The comic tetrameter resembles the tragic in every respect, except that sometimes, though very rarely, a tribrach in the seventh place is preceded by a spondee in the sixth, and that the niceties of structure just mentioned are not always observed.

The points of difference between the Greek and Latin trochaic verse are similar to those which exist in the iambic verse, and are explained in the article Terentian Metres. The chief point to be attended to is, that in Plautus and Terence a spondee which has the accent, or *ictus metricus*, on the first syllable, is allowed to stand for a trochee in any place except the seventh. The following line is from Terence:—

Númquam cuíquam nóstrum vérbum fécit néque id ægré tulít.

The *ictus metricus* of the trochaic tetrameter, both in tragedy and comedy, is as follows (according to the notation used in the article Arsis):—

/ \ // \ / \ // \ / \ // \ / \ //

that is, the *arsis* falls on the first syllable of each foot, and of the two *arses* in each metre the second is the stronger.

The trochaic verse is rapid in its movement, and is generally used where stronger emotions are expressed than in the ordinary iambic trimeter. It is, however, closely connected in rhythm with the iambic verse. If we prefix to the trochaic tetrameter catalectic an introductory short syllable, we obtain an iambic tetrameter: if from the trochaic tetrameter catalectic we cut off the first foot and a half, we have the iambic trimeter; and it must be observed that these results are not only true with respect to quantity, but that the licences and restrictions of the trochaic verse become, by thus altering the order of scansion, the very licences and restrictions of the iambic verse. Thus the *spondee in the even* places of the trochaic verse, the *anapæst* in the *fourth* and *sixth* places, the *dactyl* of a proper name, and the *want of a cæsura* between the two dimeters, produce respectively, in the iambic trimeter which we get by cutting off the beginning of the trochaic tetrameter, the *spondee in the odd* places, the *dactyl* in the *first* and *third* places, the *anapæst* of proper names, and the *penthemimeral cæsura*. The resemblance of rhythm is also seen by dividing each verse at its chief pause, namely, the end of the first dimeter in the trochaic, and the penthemimeral cæsura in the iambic, when it is found that the second portions of the two are identical in every respect; and it is in fact by these concluding portions that the rhythm of a verse is determined.

Troch. – ⏑ – ⏑ – ⏑ – ⏑ | – ⏑ – ⏑ – ⏑ –
Iamb. ⏑ – ⏑ – ⏑ | – ⏑ – ⏑ – ⏑ –

Further particulars respecting the tetrameter catalectic, and an account of other trochaic metres, will be found in Tate's *Introduction to the principal Greek Tragic and Comic Metres*, and Hermann's *Elementa Doctrinæ Metricæ*.

TROCHATELLA, Mr. Swainson's name for a subgenus of *Helicina*, which genus is placed by him next to *Cyclostoma* in the subfamily *Achatinæ*, which he makes the fourth of the family HELICIDÆ.

Subgeneric Character.—Trochiform; spire elevated, acute; inner lip very thin, outer lip spreading. (Sw.)

Example,—*Trochatella pulchella. Zool. Journ.*, i., pl. 6, f. 1.

TROCHELLA, Mr. Swainson's name for a subgenus of *Calyptræa*, Lam., placed by him under the family *Haliotidæ*.

Subgeneric Character.—Shell conical, patelliform; spire central, of two or more whorls; umbilicus closed.

Examples,—*Trochella auriculata*, Sow. (*Man.*, f. 236); and *Trochella pileus* (*Ibid.*, ff. 237, 238). [CALYPTRÆIDÆ.]

Professor Owen has contributed a most interesting addition to our knowledge of this group, in his paper read before the Zoological Society of London, on the 8th November, 1842, on the anatomy of *Lithedaphus longirostris*, the synonyms of which he gives as '*Calyptræa Roissyi*, Dufo? Upper valve, *Calyptræa equestris*, auct.? *Mitrularia equestris*, Schumacher.'

The mollusk on which the Professor has founded the genus *Lithedaphus*, was placed in his hands by Mr. Hugh Cuming on his return from the Philippine Islands in 1840, and the circumstances connected with the discovery of this species, which is inclosed, like the acephalous mollusks generally, in a bivalve shell, are related by that gentlemen in the valuable *Conchologia Systematica* of Mr. Reeve.[*]

Professor Owen remarks that the grounds on which these bivalve *Calyptræidæ* are to be regarded as a distinct genus will be manifest in the description of the soft parts; for it may be doubtful whether the mere dermal character, as, he thinks, the secretion of the basal plate by the integument of the foot must be regarded, would have justified such a separation.

The normal valve, secreted by the ordinary mantle, might, in Professor Owen's opinion, pass for the *Calyptræa equestris* of authors, and he adds that it is unquestionably very closely allied to that species, if it be not identical with it. The additional plate might be argued to be an accidental production, and it might be urged that its secretion was stimulated by the nature of the base of attachment selected by the individual Calyptreidan, or to which it had been drifted, as, for example, the masses of dead coral under which Mr. Cuming discovered the specimen submitted for dissection to Professor Owen, who adverts to the species of *Calyptræa* already discovered by M. Dufo at Mahé, one of the Seychelle islands,[†] which at the later periods of its existence is provided with a separate calcareous supporting plate. M. Dufo considers this species, named by him *Calyptræa Roissyi*, as distinct from *Calyptræa equestris*, in consequence of its having the margin of the upper shell dentated and exactly on the same plane, and the angle formed by the internal plate less open; but still he thinks that it is otherwise very closely allied.

Now, Professor Owen remarks that the specimens received by him from Mr. Cuming have also the contour of the shell-aperture on the same plane, and in the older specimens the loose-ribbed texture of the outer layer of the shell gives, the Professor observes, a dentated structure to the margin; but he adds that in the specimen figured by Mr. Reeve the margin of the upper shell is sinuous, as in most specimens of *Calyptræa equestris*, and that the known facility with which mollusks can adapt the calcifying margin of their flexible and extensible mantle to the inequalities of the surfaces on which they rest materially invalidates the chief specific character of *Calyptræa Roissyi*, which, together with *Calyptræa equestris* and *longirostris*, may, he thinks, possibly be varieties of one species; but the organization of this species, as represented by the specimens from Zebu and Bohol, establishes, in his opinion, their claim to subgeneric distinction among the *Calyptræidæ*.

Before Professor Owen proceeds to his description, he refers to the materials for the requisite comparisons furnished by the labours of other anatomists, observing that Cuvier has taken the lead in giving the anatomy of *Crepidula*, in the *Mémoires sur les Mollusques*, but that the first anatomy of a typical *Calyptræa* is due to the skill of M. Deshayes.[*] M. Lesson has noticed modifications of Calyptrean organization in the subgenus *Crepipatella*,[†] and Professor Owen has himself described others in the subgenus *Calypeopsis*.[‡]

External Characters.—*Lithedaphus*, according to Professor Owen, differs from all previously described *Calyptræidæ* in the following points:—The head, instead of being short, broad, and flat, is long and subcylindrical: the part anterior to the tentacles being produced in the form of a proboscis equalling in length the whole body behind it, and terminated by a clavate extremity. The tentacles or antennæ are of proportional length, reaching, in some specimens, to the beginning of the terminal expansion of the proboscis. The second external character is a moderately-long subcompressed process, projecting forwards between the head and the anterior margin of the foot, like a second head, but consisting only of a soft duplicature of the mantle, with muscular fibres for protraction and retraction. In some specimens the apex of this process was expanded and a little produced on each side. The more common form of this appendage is contracted.

The foot, in the specimens examined, was much smaller in proportion than in *Calyptræa* or *Calypeopsis*; it presents a subcircular form, as in *Cal. sinensis*, but only equals half the diameter of the entire body; its whole margin is free, not produced anteriorly into lobes, as in *Calypeopsis*. The dorsal surface of the mantle is impressed with a deep horse-shoe fissure, receiving the internal plate of the upper shell. The more common form of this appendage is contracted.

Internal Characters.—Respiratory and Circulating Systems; Digestive and Generative Systems.—Professor Owen states that the aperture of the branchial chamber extends transversely across the back of the head, but conducts to a cavity of unusually small extent. The contained breathing organs differ not merely in relative size, but likewise very remarkably in structure, from the previously dissected *Calyptræidæ*. In these the branchiæ consist of a single series of simple, elongated, close-set and very numerous filaments, extending along the left side of the body in *Calyptræa sinensis*, and making the tour of the mantle in the *Calypeopsis*. In *Lithedaphus* the branchiæ consist of two short parallel rows of conical, subcompressed, plicated vascular processes, twelve to fourteen in each row, and limited, like the branchial cavity, to the anterior part of the dorsal aspect of the body. The heart, lodged in a wide pericardium, and consisting of a large auricle with thin, subtransparent walls, and a small opake, conical ventricle, is situated at the left extremity of the branchial chamber, receiving the branchial veins, and sending its largest artery to the ovarium, which, in the specimen dissected, formed the left portion of the visceral mass. The oviduct, at first slender and convoluted, expands on the right side, where it is disposed in three long folds, which were laden with unusually large elliptical ova. At its termination, close to the branchial orifice, there is an oval mucous gland, and a short conical filament projects from the inner surface of the mantle. The proboscis is surrounded by a thick muscular tunic, inclosing a long, rasp-like, horny tongue, and at its base are two simple salivary follicles. The œsophagus expands into a small stomach, imbedded in a follicular liver. The intestinal canal is more complicated than in *Calyptræa* or *Calypeopsis*; it bends towards the left side, and there forms a small mass of double spiral coils, five or six in number, from which the rectum is continued along the floor of the branchial chamber, in the interspace of the gills, to the outlet of that chamber on the right side of the neck.

Nervous System.—The nervous system of *Lithedaphus*, according to the Professor, is chiefly distinguished from that of the *Calypeopsis* by the larger relative size and closer approximation of the supraœsophageal ganglions, which here equal the inferior masses. Besides the chords connecting the upper with the lower ganglions, the upper ganglions give off each three nerves; the largest runs forward in a zigzag course to the clavate mouth; the second supplies the substance of the tentacle; the third, a slender nerve, goes to the minute eye-speck on the outer side of the base of the tentacle. The wavy disposition of these nerves, especially of the rostral pair, clearly indicates a provision for considerable elongation of the parts which they supply.

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[*] Vol. ii., p. 31, note.

[†] See 'Ann. des Sciences Nat.,' 2de ser., tom. xiv.

[*] 'Ann. des Sciences Nat.,' tome iii.

[†] 'Zoologie de Duperrey,' tome ii.

[‡] 'Zool. Trans.,' vol. i.

Professor Owen, referring to these accurate demonstrations, remarks that this genus differs from the other known forms of the *Calyptræidæ* in the smaller development of its locomotive and respiratory organs, and in the greater development of the organs for the prehension and assimilation of food. He concludes one of the most succinct and at the same time most satisfactory papers on the anatomy of these animals known to us, in the following eloquent and philosophical terms:

'Probably no oyster, cemented to its native rock, is more fettered in its movements than this highly developed gastropod, to which however a voluntary detachment of the foot from the gastric plate may be possible.

'M. Dufo however testifies that the only movement he was able to recognise in his *Calyptræa Roissyi* was an elevation of the anterior part of the shell and a corresponding separation of it from the supporting plate beneath.

'The circumstances under which Mr. Cuming discovered his specimens would hardly be consistent with a greater extent of motion. The foot, therefore, whose normal functions as an instrument for traversing space must be restricted to the early age of the *Lithedaphus*, may well offer diminished proportions when the animal has chosen a site for the deposition of its ventral plate and has taken up a fixed abode. Muscular action being thenceforward much restricted, the necessity for extensive respiration is in the same degree abolished. The compensation for this abrogation of the power of moving about in quest of food is obviously the great development of the proboscidiform head, which when outstretched in the living mollusk must appear like some worm moving to and fro from between the valves of the shell. The tactile organs of sense are co-extended with the prehensile organ; but the eyes, so useful to the young wandering mollusk, have much shrunk in the sedentary aged; and the complete elaboration of whatever nutriment may be introduced into the system has been provided for by the long and convoluted alimentary canal.

'These facts in the anatomy of the *Lithedaphus*, and their harmonious adjustment to its peculiar condition as a sessile gastropod inclosed in a bivalve shell, leave scarcely any doubt as to this state, strange and anomalous though it may seem, being essential to its nature and of original design.

'For assuming that the secretion of a ventral plate may be excited by some accidental position of an individual of a species not commonly possessing such plate, it would be an extreme hypothesis to attribute to the consequent abrogation of the locomotive power a gradual and progressive elongation of the head during successive endeavours on the part of the imprisoned mollusk to attain whatever food might come within its reach.

'And admitting that, the supplies of food being casual and scanty, the nutriment would require to be longer retained and more completely assimilated, to conclude that the alimentary canal thereupon acquired additional convolutions would be still more hazardous. But when we find that, the demands upon the respiratory actions being much diminished after the loss of locomotion, the branchial apparatus does not merely present an atrophied state of its usual structure in the free *Calyptræidæ*, but a different condition of that structure,—two very short gills replacing one very extensive one, and the form of the branchial filaments being quite different,—the conclusion seems unavoidable, that the *Lithedaphus* is a good and constant genus, created with reference to that peculiar mode of life to which its generic characters as a Calyptreidan are correlated.'

TRO'CHIA, Mr. Swainson's name for a genus of *Buccininæ*, the fifth subfamily of his *Muricidæ*. The genus is placed between *Buccinum* and TRITONOIDEA.

Generic Character.—Shape intermediate between *Purpura* and *Buccinum;* whorls separated by a deep groove: inner lip, when young, depressed; when adult, thickened, convex, and striated: basal canal very small.

Example, *Trochia sulcata.* 'Enc. Méthod.,' pl. 422, f. 4.

TRO'CHIDÆ, the name of a family of testaceous turbinated gastropods.

The genus *Trochus* of Linnæus (*Animal Limax*) was placed by him between *Murex* and *Turbo*, in his last edition of the *Systema Naturæ*, and comprised twenty-six species.

The *Trochoidea* of Cuvier form the first family of his pectinibranchiate gastropods [PECTINIBRANCHIATA], and are defined by him as distinguishable by their shell, whose aperture is entire, without notch or canal for a mantle-siphon, the animals being destitute of one; and by an operculum or some organ in lieu of it. They are, Cuvier observes, the *Paracephalophora Dioica Asiphonobranchiata* of M. de Blainville.

The following genera and subgenera are arranged by Cuvier under his *Trochoides*:—

Les Toupies. (Trochus, Linn.)

These are defined as having shells whose angular aperture approaches at its external border more or less to the totality of a quadrangular figure, and is on an oblique plane with reference to the axis of the shell, because that part of the border next to the spire advances more than the rest. The greater part of their animals have three filaments on each edge of the mantle, or, at least, some appendages at the sides of the foot.

Subdivision α. No umbilicus.

Among those which have no umbilicus to the shell, there are some whose columella, in form of a concave arch, is continued, without any projection (ressaut), with the external lip. It is the angle and advancement of this lip which distinguishes them from *Turbo*. These are the *Tectaires* (*Tectus*) of De Montfort.

Many are flattened, with a trenchant lip, which has caused them to be compared with a spur-rowel. These are the *Eperons* (*Calcar*) of De Montfort.

Some are slightly depressed, orbicular, shining, with a semi-round aperture, and a convex and callous columella. (*Rotella*, Lam.)

Others have the columella distinguished towards the bottom by a small prominence, or vestige of a tooth, like that of the *Monodontæ* of Lamarck, from which these *Trochi* do not differ except in the angle of their aperture and the advancement of their lip. The aperture is, ordinarily, as high as it is wide. (*Cantharidus*, De Montf.)

Others again have the aperture much wider than it is high, and their concave base approximates them to the *Calyptrææ* (*Infundibulum*, De Montf.).

Some whose aperture is much larger than it is high have the columella in the form of a spiral canal (*Trochus foveolatus*, &c., Chemn.).

Those which have the shell turriculated approach the *Cerithia* (*Telescopium*, De Montf.).

Subdivision β. Umbilicated.

Some of the forms which are placed in this subdivision have no projection (ressaut) at the columella: the greater part are flattened, and have the exterior angle trenchant. *Trochus agglutinans* (genus *Phorus*, De Montf.), &c.

Some have the edges of the lip rounded (*Trochus cinerarius*, Linn.).

Others have a prominence towards the lower part of the columella (*Trochus virgatus*, &c.).

Others again have the collumella crenelated on its length (*Trochus maculatus*, &c.).

Next to the *Trochi*, properly so called, come

Les Cadrans. (Solarium, Montf., Lam.)

These are distinguished from the other *Trochi* by having a spire in the form of a very widened cone, whose base is hollowed by an extremely wide umbilicus, so that one can follow with the eye the internal edges of all the whorls marked by a crenelated *cordon*. (*Trochus perspectivus*, &c.)

Les Euomphales. (*Euomphalus*, Sow.)

These are fossil shells resembling the *Solaria*, but without any notches on the internal whorls of the umbilicus.

Next in order follows the genus *Turbo*, Linn., with its subgenera [TURBINIDÆ], and then come the genera *Paludina*, *Littorina*, *Monodonta*, or rather *Monodon*, *Phasianella*, *Ampullaria* with its subgenera, *Melania* with its subgenera, *Acteon* (*Tornatella*, Lam.), *Pyramidella*, *Janthina*, and *Nerita* with its subgenera.

The *Trochoides* are immediately followed by the *Capuloides* (*Capulus*, *Hipponyx*, *Crepidula*, &c.). (*Règne Animal.*)

M. de Blainville makes the *Goniostomata* his first family of the order *Asiphonobranchiata*, and includes within it the great genus *Trochus*, Linn., only. He describes the

Animal as spiral, having the sides of the body often ornamented with digitated or lobated appendages, and provided with a short foot rounded at its two extremities; the head furnished with two tentacles, more or less elongated, carrying the eyes on a convexity of their external base, which is often sufficiently distinct to render the eye subpedunculate; mouth without any upper tooth, with a lingual spiral riband; anus on the right, in the branchial cavity, which holds one or two unequal, comb-like branchiæ; organs of generation terminating in a female individual on the right in the branchial cavity, and in a male individual in a sort of triangular tonguelet sustained by a small ossicle.

Shell subplanorbic or trochiform; the spire elevated, sometimes depressed (surbaissée), and more or less carinated on its last whorl, which forms a flat circular base; a moderate, depressed, and often nearly quadrangular aperture, with its external or right lip trenchant, angular, or folded in the middle.

Operculum horny, circular, with a submedian summit, rolled regularly into a spiral; the whorls of the spire narrow and numerous.

M. de Blainville observes that all the species of this family are phytiphagous, marine, and live upon the rocks on the shore of the sea. He divides the group into *Solarium* and *Trochus*.

Solarium.

Animal unknown. (But see, post, descriptions and figures of *Solaria perspectivum* and *variegatum*.)

Shell orbicular, rolled up (enroulée) nearly on the same plane, or planorbic; spire very much lowered (surbaissée); a large conic umbilicus, with its edges denticulated or not at the entrance; aperture not modified by the last whorl of the spire, which is entirely flat; no columella.

Operculum unknown, Blainv. (But see the descriptions and figures of the opercula of the *Solaria* above-mentioned.)

M. de Blainville separates the genus into the following subdivisions:—

A. Species very much carinated on their circumference and the aperture of which is well squared.

Example, *Solarium perspectivum*.

B. Species subcarinated or with a double carination; the aperture sub-rounded.

Example, *Solarium variegatum*.

C. Species entirely flat on the side of the summit; the umbilicus not crenelated at its circumference.

Example, *Solarium magnum*. (Genus *Maclurites*, Lesueur.)

D. Species with a slightly conical summit; the umbilicus not crenelated. (Genus *Euomphalus*, Sowerby.)

Example, *Solarium antiquum*.

Trochus.

Animal well known, and as characterized above.

Shell thick, ordinarily nacreous, trochoïd, with the spire sometimes lowered (surbaissée) and at others rather lofty (elancée) and pointed at the summit, trenchant or carinated on its circumference, umbilicated or not; aperture depressed, angular or subangular, with disunited borders, the right lip trenchant; the columella bent, twisted, and often projecting in front.

Operculum horny, delicate, consisting of numerous narrow spiral whorls, increasing slightly from the centre to the circumference. (Blainv.)

M. de Blainville thus subdivides this genus:—

A. Species entirely calyptriform in consequence of the great projection of the carina or of the circumference, its excavation, and the smallness of the spiral cavity formed by a septiform lamina. (Genus *Infundibulum*, De Montf.)

Example, *Trochus concavus*.

B. Umbilicated species, with the spire much depressed and agglutinating; the base very much widened and excavated as it were by the great projection of the angle of the right lip, which advances far beyond the columellar rounded lip. (Genus *Phorus*, De Montf.)

Example, *Trochus agglutinans*.

C. Umbilicated species with a very depressed spire, trenchant, and radiated at their circumference by an angular canal of the middle of the right lip (Genus *Calcar*, De Montf.)

Example, *Trochus Imperialis*.

D. Orbicular, depressed, shining, subcarinated species the aperture subdepressed and semi-round, with a large callosity on the umbilicus. (Genus *Rotella*, Lam.)

Example, *Trochus roseus*.

E. Species not umbilicated, conical, with a flat and circular base, the columella twisted; the aperture very angular.

Example, *Trochus niloticus*.

F. Species not umbilicated, conical, elevated, with a circular and flat base; the termination of the columella strongly twisted, but depressed by the lip appearing to be notched by the advance of an internal decurrent fold. (Genus *Tectus*, De Montf.

Example, *Trochus obeliscus*.

G. Species neither umbilicated nor nacreous, conical, very much elevated; whorls of the spire numerous, with decurrent striæ; the extremity of the columella strongly twisted and reaching beyond the origin of the lip. (Genus *Telescopium*, De Montf.

Example, *Trochus telescopium*.

H. Species not umbilicated, conical, with an oblique base; the aperture large, slightly angular; the columella twisted and forming a species of tooth at its termination. (Genus *Cantharidus*, De Montf.)

Example, *Trochus iris*.

M. Rang makes the genus *Trochus* more comprehensive, for he comprises under it the following subgenera — 1. *Subot* (*Turbo*, Montf., and *Lacuna*, Turton). 2. *Meleagris*, Montf. 3. *Monodonta*, Lam. 4. *Delphinula*, Lam. 5. *Calcar*, Montf. 6. *Phorus*, Montf. 7. *Cirrhus*, Sow. 8. *Solarium*, Lam. 9. *Euomphalus*, Sow. 10. *Infundibulum*, Montf. 11. *Trochus*, Montf. 12. *Telescopium*, Montf.

Mr. Swainson places the *Trochidæ* between the *Turbidæ* (*Turbinidæ ?*) and the *Haliotidæ*, with the following character, and without noticing the animal:—

Shell mostly trochiform (except *Phasianella*), the substance almost always 'perlaceous;' outer lip never thickened; aperture entire, closed by a shelly or horny operculum.

The following are the subfamilies and genera included by Mr. Swainson under this family:—

1. *Senectinæ.* Snake shells.

Operculum round; calcareous; shell turbinate; the basal whorl varicose; pillar always smooth; aperture round, rarely oblique.

Genera: *Senectus*, Humph. (This genus appears, from the specific names given, to be the true *Turbo* of authors—*Turbo marmoratus*, *T. pethiolatus* (*peiholatus ?*), *T. argyrostomus*, &c.); *Marmorostoma*, Sw.; *Delphinula*, Lam.; *Cyclocantha*, Sw.; and *Cidaris*, Sw.

2. *Trochinæ.* Trochus, or Top.

Shell trochiform; the body more or less wide and flattened beneath; the spire conical or pyramidical; aperture oval, wider than it is high; operculum horny. (Mr. Swainson adds, except in the first genus and in *T. niloticus*.)

Genera: *Canthorbis*, Sw. (with the subgenera *Tubicanthus*, Sw.; *Canthorbis*, Sw. (*Suns*); *Pyramidea*, Sw.; *Lamprostoma*, Sw.; and *Carinidea*, Sw.); *Trochus*, Linn. (with the subgenera *Chlorostoma*, Sw.; *Trochus*, Linn.; *Pagodella*, Sw.; *Trochidon*, Sw.; and *Calliostoma*, Sw.); *Monodonta*, Lam. (with the subgenera *Elenchus*, Humph.; *Echinella*, Sw.; *Monodonta*, Lam.; *Fragella*, Sw.; and *Monilea*, Sw.); *Solarium*, Lam.; and *Onustus*, Humph.

3. *Rotellinæ.*

Substance 'perlaceous;' shell depressed, smooth, and highly polished; mouth thin; umbilicus closed. Mr. Swainson adds that these have probably no operculum, and that *Rotella* may be an internal shell.

Genera: *Chrysostoma*, Sw.; *Rotella*, Lam.; and TURLIDOMUS, Sw.

[N.B. The following is the description given by MM. Quoy and Gaimard of the animal *Rotella lineolata*, published in 1834. Figures are also given which show that the shell is not internal.

The animal is very spiral, with an elongated oval foot, folding itself longitudinally, in order that it may re-enter the shell, carrying at its posterior part a round membranous operculum, absolutely, as in the true *Trochi*, with large and very distinct whorls. The lateral fringes of the feet are snipped as it were (découpées), and furnished on each side with four long loose filaments. The muzzle is moderate. The tentacles are very long and slender; the terminal eyes are carried on very long pedicles, such as MM. Quoy and Gaimard had never seen in any mollusk, for they do not resemble those of the *Strombi*, which are also very much developed.

The pulmonary cavity is very open; a long gill goes from the left border to the right: its lamellæ are rigid, rounded, and free near their two points, which appeared to the observers black. The anus and uterus are placed on the right side. Under the tentacle of this side is a rather large auricle, hollowed into a gutter, which is never wanting in any individual, serving, no doubt, to direct the exit of the eggs in this mollusk, which is very probably hermaphrodite, like all those of the family to which it belongs. The gill appeared to MM. Quoy and Gaimard, different from that of the *Trochi*. They further state that these animals being very small, and their specimens not fresh, their remarks are not so complete as they could have desired. The same observation applies to the colours. Nevertheless they state that one may see that the tentacles are yellowish, annulated with brown; and that the muzzle is circled with black as well as the edge of the mantle. The colouring of the gill is, they add, a rare occurrence in the mollusks, where it is hidden under the double envelope which the mantle and the shell form. (*Zoologie de l'Astrolabe*; and see the *Atlas*, pl. 61.)]

4. *Pleurotomariæ.* (*Pleurotomarinæ?*)

Trochiform; the aperture with a slit or fissure. Fossil only.

Genus, *Pleurotomaria*, Defrance.

5. *Phasianellinæ.*

Obovate, spiral, polished; aperture oval; spine longer than, or equal to, the aperture; operculum shelly.

Genus, *Phasianella*. (*Malacology*, 1840.)

Mr. J. E. Gray makes the *Trochidæ* the second family of his *Podophthalma*, the first section of the order *Phytophaga* in his arrangement. The *Trochidæ* are immediately preceded by the *Turbinidæ* and followed by the *Stomatellidæ*.

Mr. Gray's *Trochidæ* consist of the genera *Pyramis*, *Cardinalia*, *Trochus*, *Polydonta*, *Clangulus*, *Phorcus*, (*Phorus?*), *Ziziphinus*, *Canthiridus* (*Cantharidus?*), *Thalotia*, *Monodonta*, *Gibbium*, *Gibbula*, *Rotella*, *Livona*, *Talopia*, *Camitia*, and *Delphinula*. (*Synopsis Brit. Mus.*, 1840.)

In this article we shall confine ourselves to the genus *Trochus*, as it is restricted by De Blainville and other authors. Not that our space will admit of a description or illustration of even a very small part of the multitudinous and highly interesting species comprehended under that genus; but we shall endeavour to lay before our readers two or three of the forms, so as to convey some idea of the shells and inhabiting animals. This group is highly ornamental in collections, both on account of the shape of the shells and the colours with which many of them are ornamented: some grow to a considerable size; and few collectors are satisfied till they have obtained fine specimens of the *Carrier Shells* (or *Mineralogists* and *Conchologists*, as they are termed, according to their selection of shells or minerals for agglutination to their own shells), the *Suns*, and the *Perspective shells*.

Trochus.

The number of recent species of *Trochus* recorded by M. Deshayes in his tables is one hundred and three, and there is reason for believing that this is under the mark.

Geographical Distribution and Habits.—These plant-eating marine gastropods are very widely diffused, there being few seas without some of the species: they have been captured at depths varying from the surface to forty-five fathoms, creeping on rocks and sea-weeds, sand, sandy mud, and gravel.

We proceed to the promised illustration of one or two of the forms.

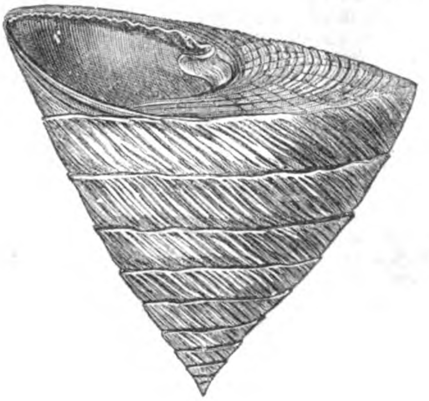
Examples.—*Trochus obeliscus.* *Shell* conico-pyramidal, nodulous and granulous, coloured with green and white; the whorls tuberculato-nodose, and girt with many granose circles; the last whorl, as it were, removed or taken away (dempto); the lower surface planulate; the lip sinuated at the base.

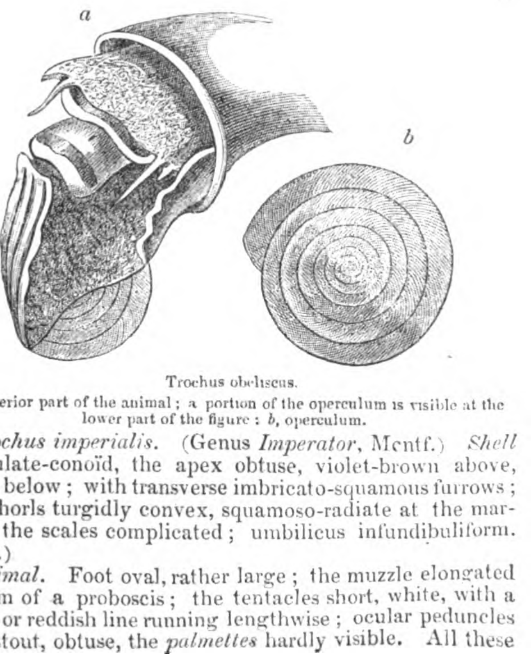
Such is Lamarck's description, but the species figured by MM. Quoy and Gaimard in the 'Zoologie' of the Astrolabe is comparatively smooth: the figure in Knorr referred to by Lamarck is neither very nodulous nor very granulous, and the species represented in the Atlas of the Astrolabe may be a smooth variety.

Animal with stout and short tentacles, which are white with a brown border; the ocular peduncles large, pointed, and doubly circled with black. The muzzle is very wide, with a black riband near its border, as well as the head, which is moreover dotted with greenish. The foot is yellow below, and so dotted with brown on its sides, that it appears black. The edge of the mantle is variegated with brown and greenish. The fringes of the feet are white and without filaments. (Quoy and Gaim.)

Localities.—Lamarck gives the Indian Ocean as the habitat of his species. MM. Quoy and Gaimard, who captured the individual above described at Tonga, remark that in colour it is *Trochus obeliscus*, but that it tends to *Trochus acutus* in its suddenly-pointed spire.

The same zoologists observe that the *opercula* of *Trochi* known in collections are nearly all of a chestnut colour. This, they remark, is ordinarily due to the action of the air, for on the living animal they are transparent and yellowish. In the very turriculated species the animal draws itself back into the shell obliquely, dragging in with it in this manner its operculum, which otherwise could not lie flat in the aperture, which is always more or less flattened. These animals, they add, show themselves but little, and hide themselves far in, so that none of their parts can be perceived. It is even necessary to break the first whorl of he shell in order to draw them satisfactorily. (*Astrolabe.*)





Trochus obeliscus.

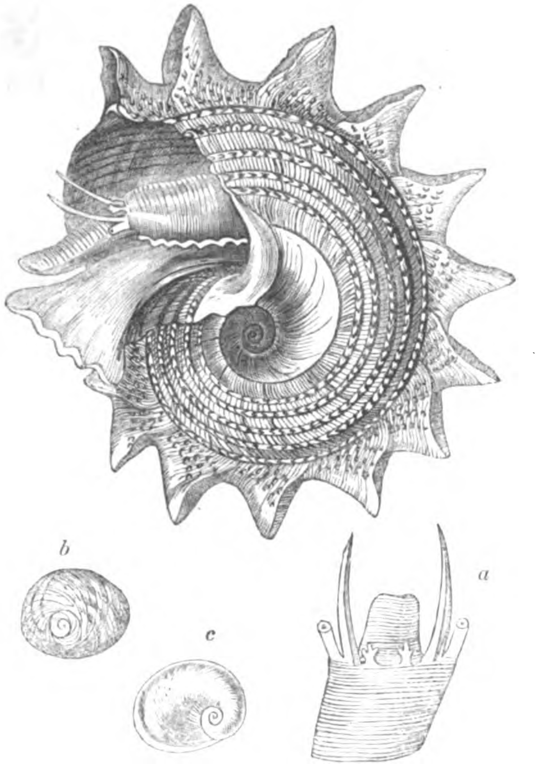
a, anterior part of the animal; a portion of the operculum is visible at the lower part of the figure: *b*, operculum.

Trochus imperialis. (Genus *Imperator*, Montf.) *Shell* orbiculate-conoïd, the apex obtuse, violet-brown above, white below; with transverse imbricato-squamous furrows; the whorls turgidly convex, squamoso-radiate at the margin; the scales complicated; umbilicus infundibuliform. (Lam.)

Animal. Foot oval, rather large; the muzzle elongated in form of a proboscis; the tentacles short, white, with a black or reddish line running lengthwise; ocular peduncles very stout, obtuse, the *palmettes* hardly visible. All these parts are whitish: the head and the mouth are striated across with black and violet: this last colour belongs only to the left side. The foot has some very bright marks on its sides: its lateral fringes are without filaments.

Operculum oval, smooth, whitish, and a little convex (renflé) towards one of its extremities. (*Astrolabe.*)

MM. Quoy and Gaimard, who observe that the *operculum* of this species determined them to place it in the genus *Turbo*, state that it has only been hitherto found at New Zealand, where it is rare. They never obtained more than one living specimen: that from which the description and figure were taken was small, being only two inches in diameter, comprising the spines. It was covered with calcareous incrustations and marine plants, indicating the sloth of the animal: they found it in the Passe des Français, Tasman Bay.



Trochus imperialis, with animal.

a, anterior part of animal seen from above; *b*, inside of operculum; *c*, outside of the same.

Solarium.

The number of recent species recorded by M. Deshayes in his tables is twelve.

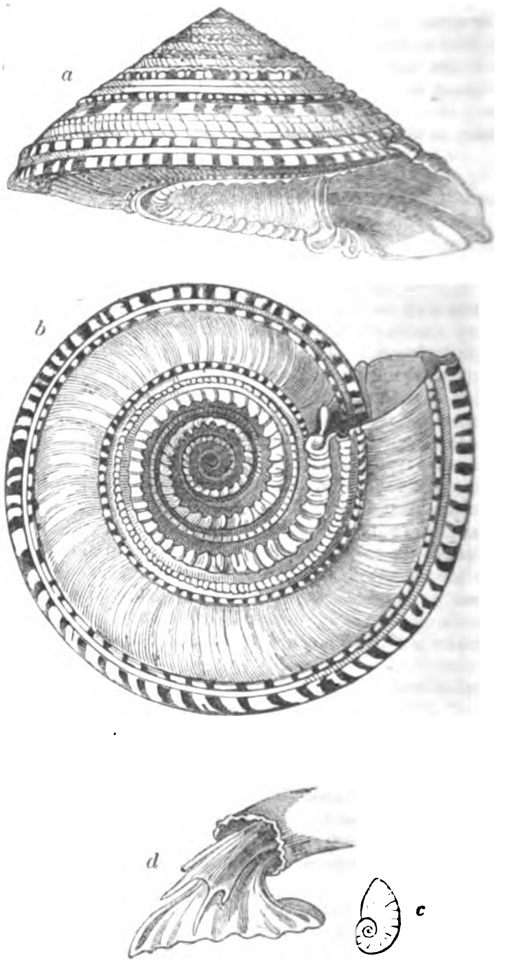
Geographical Distribution and Habits.—The species of this genus hitherto found have occurred in the seas of the warmer climates. The Mediterranean, the Indian Ocean, the coasts of Tranquebar, the South Seas, and those of New Holland, are the localities recorded by Lamarck. The specimens have been found near the shore—it seems to be a littoral genus—on rocks and weeds.

Examples.—*Solarium perspectivum. Shell* orbiculate-conoïd, longitudinally striated, whitish-yellow, with articulated belts of white and brown or chestnut near the sutures; the notches of the umbilicus small. (Lam.)

Animal with a large foot widened in front, and having a very strongly developed marginal furrow, yellowish on the sides, marked with a black stria above. The head presenting a large escutcheon. The tentacles short, stout, and marked with two longitudinal black bands on the sides. At their base are placed the eyes on very short pedicles. The branchial cavity appeared to be partially divided in two, lengthwise, by a sort of fold. The intestine describes two rather considerable circumvolutions before it passes the liver.

Operculum large, oval, membranous, and strongly but sparingly spiral at one of its extremities. The colour is yellowish, like that of the whole animal.

MM. Quoy and Gaimard, who have given this description of the animal in the 'Zoologie' of the Astrolabe, state that they know nothing of the habits of this species, which was brought to them nearly dead by a Malay of Amboyna.



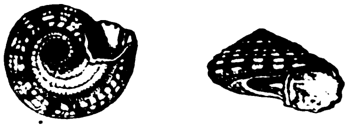
Solarium perspectivum.

a, front view; *b*, seen from below; *c*, operculum; *d*, anterior part of the animal. (Operculum and animal from the Atlas of the Astrolabe.)

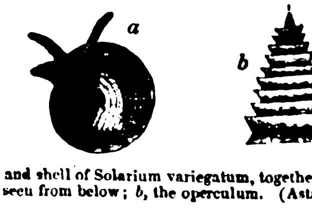
Solarium variegatum.—*Shell* orbiculate-convex, transversely sulcated, longitudinally striated articulately, variegated with white and bay; umbilicus patulous and crenelated. (Lam.)

Animal nearly of the same colour as the shell, which it secretes; for it is brown, dotted with black, on all parts. The tentacles are stout, long, obtuse, carrying the eyes at a certain distance from their base on a convexity. The foot is oval, rather large, widened, notched, and auriculated in front.

It carries at its posterior part one of the most singular of *opercula*, of an unique form among mollusks, and already known in collections by the account of M. de Roissy, but without the knowledge of the species to which it was to be referred. It is a long, solid, calcareo-membranous cone, carrying membranous lamellæ spirally throughout its length. The interspaces are as it were ribanded. (Quoy and Gaimard.)



Shell of Solarium variegatum.



a, the animal and shell of Solarium variegatum, together with the operculum seen from below; *b*, the operculum. (Astrolabe.)

MM. Quoy and Gaimard observe that notwithstanding the form of this operculum, it may be seen, by the disposition of its elements, that it is returning to those of the true *Trochi*. It does not enter completely into the shell, the aperture of which it well fills. They notice the smallness of the specimen which they obtained, the size of which they say prevented them from pushing further their researches as to its organization. It came from Carteret Harbour in New Ireland.

Fossil Trochi and Solaria.

Trochus.—M. de Blainville states that Lamarck enumerates nine fossil species, and Defrance fifty-six, eleven of which the last-mentioned zoologist considers as analogous: six are from Italy, and thirty-eight from Grignon.

Mr. G. B. Sowerby observes that the fossil species, which are rather numerous, belong to the newer formations, such as the crag, the calcaire grossier, and the green-sand: they are also, he adds, found in the London clay, and he remarks that he has reason to believe that some species occur so low down as the lias.

The number of fossil species of *Trochus* recorded by M. Deshayes in his tables is seventy (tertiary); and of these *Trochi magus, fagus, cingulatus, agglutinans, Adansoni, conulus, cinerarius, conuloides, Matoni, zizyphinus, strigosus*, and *obliquatus*, are given as species found both living and fossil (tertiary). *Trochus crenulatus* is noted among those species which are found in more than one tertiary formation, but does not occur in the living and fossil list. Mr. Lyell, however, under the head of 'Fossil Shells collected by him in Ischia, and named by M. Deshayes,' mentions *Trochus crenulatus* as one of four shells sent to him from Ischia, all of recent species. Mr. Lyell enumerates also, among the fossil shells from the western borders of the Red Sea, collected by Mr. James Burton, and communicated by G. B. Greenough, Esq., *Trochi maculatus, virgatus*, and *mauritianus*, all described as recent by Lamarck. Among the fossil shells collected by him at Sienna, he notices *Trochus fermonii*, and a new species, with its colour. (*Principles of Geology.*)

That *Trochus* occurs below the chalk appears from Dr. Fitton's valuable list, where *Trochus Sedgwickii* is recorded both from the upper green-sand of the Isle of Wight, and from the Oxford oolite in Dorsetshire, and another uncertain species from the last-named locality. See this list also for localities of *Pleurotomaria.* (*Strata between the Chalk and Oxford Oolite.*)

Nor is it wanting in the Silurian rocks, where Mr. Murchison records the presence of the genus in the old red sandstone (middle and lower beds only), in the upper Ludlow rock, and (with a ?) in the Caradoc sandstone. In the same elaborate work *Pleurotomaria* is noted from the lower Ludlow rock and from the Caradoc sandstone. (*Silurian System.*)

Solarium.—M. de Blainville observes that Lamarck records eight fossil species, and Defrance seventeen, some of which are subanalogues from the calcaire grossier. M. de Blainville also notes the fossil *Solarium magnum* (Maclurite) from North America, and adds that Defrance enumerates eight species of *Euomphalus* (fossil).

Mr. G. B. Sowerby observes that a few fossil species occur in the tertiary beds; and that there are some fossils belonging to the lower beds of oolitic formation, and even as low as the mountain limestone, which resemble them very nearly: these, he adds, form the genus *Cirrus* of some authors, and do not appear to him to possess any characters by which they may be generically distinguished from the *Trochi, Turbines*, or *Solaria.*

M. Deshayes, in his tables, makes sixteen the number of fossil *Solaria* (tertiary), and names *Solaria variegatum, carocollatum*, and *pseudo-perspectivum* as species found both living and fossil (tertiary).

In the list of Red Sea shells above referred to *Solarium perspectivum* appears.

That the genus occurs below the chalk is evident from Dr. Fitton's *List*, also above referred to, where three species are recorded from the upper green-sand, the gault, and Blackdown. *Cirrus* is also noted from the upper green-sand of Dorset.

Solarium does not appear among the fossils of the Silurian rocks, but no less than nine species of *Euomphalus* are recorded in Mr. Murchison's tables, coming respectively from the Aymestry limestone, the lower Ludlow rock, the Wenlock limestone, the Wenlock shale, the Caradoc sandstone, and the Llandeilo flags.

These works are only quoted as examples out of many fossil lists which should be examined by the student.

Here may be best noticed the *Rotella nana* (from the Claiborne beds, Alabama, tertiary) of Mr. Lea, who observes that he is not aware that the genus *Rotella* has before been observed in a fossil state in America or in Europe, and refers to the tables of M. Deshayes, who gives four recent species, but none fossil. (*Contributions to Geology.*)

TRO'CHIDON. [Trochidæ.]

TROCHI'LIDÆ, the scientific name for the family of *Humming-Birds.*

Linnæus, in his last edition of the 'Systema Naturæ,' placed the genus *Trochilus* at the end of his order *Picæ*, and next to the genus *Certhia.*

Cuvier includes the *Colibris* (*Trochilus*, Linn.) in his order *Passereaux*, placing the group between the *Grimpereaux*, or Creepers (*Certhia*, Linn.), which in Cuvier's arrangement comprises the Sun-Birds and the Hoopoes (*Upupa*, Linn.).

The views of Mr. Vigors with regard to this family will be found in the article Sun-Birds, vol. xxiii., p. 284.

M. Lesson, in his 'Manuel,' places the *Trochilidæ* next to the *Philedonidæ*, and at the end of the Tenuirostres, making the family consist of two genera only, viz. *Colibri* (*Polytmus*, Briss.; *Trochilus*, Linn. et Auct.), and *Ornismya*, Less. (*Mellisuga*, Briss.; *Trochilus*, Linn., Temm., Vieill.; and *Orthorhynchus*, Lacép.). The same zoologist, in his elegantly illustrated work 'Les Trochilidées, ou les Colibris et les Oiseaux Mouches,'* gives the following classification of this brilliant group:—

Trochilus, auctorum.

Synonyms:—*Mellisuga et Polytmus*, Briss.; *Trochilus*, Linn., Gm., Lath., Vieill., Temm.; *Trochilus et Orthorhynchus*, Lacép.; *Trochilus, Cynanthus, Phœthornis, Campylopterus* et *Lampornis*, Sw. ('Zool. Journ.'); *Trochilus, Ramphodon*, et *Ornismya*, Less.; *Bellatrix, Calliphlox, Polytmus, Glaucis, Anthracothorax, Heliactin, Hylocharis, Basilinna, Chrysolampis, Smaragdites*, et *Eulampis*, Boie ('Isis,' 1831).

Zoological Characters.—*Bill* longer than the head straight or arched, the upper mandible a little widened at the base, rounded above and beyond the nostrils, tapering into a point. Lower mandible straight or slightly bent above and below, entering within the upper mandible, dilating a little towards the point, and of the same length as the preceding.

Nostrils basal, very small, covered by the advanced feathers of the forehead, placed in a lateral fosset, separated from each other by a slight ridge.

Wings with the quill-feathers graduated. The first the longest, and so on in succession.

Tail composed of ten feathers, very variable in length and form.

Tarsi delicate, slender, naked or feathered to the heels, scutellated, having in front three equal toes, the two internal ones a little connected at their base, the hind toe rather stout, all furnished with compressed, curved, and hooked claws, which are rather robust for the toes.

Tongue extensible, long, divided at the summit into two widened filaments, which are slightly spatulate, and supported by two very long branches of the os hyoides acting like a spring, tubular in the centre, or formed of two co-adapted (adossés) cartilaginous canals.

Geographical Distribution.—America (including many of the adjoining islands), principally between the tropics; but, at the same time, there are species which range very far to the south, and others to the north.†

Food.—Soft insects, such as spiders, tipulæ, gnats, ants, and also small coleopterous insects; accessorily the honied juice of flowers.

Plumage.—That of the *male* brilliant, sumptuous, and with metallic reflections. The livery of the *females* is nearly always sombre, tarnished, or with but little briliancy. The *young* resemble the females, and only gradually gain the dress of the males. The feathers have their barbules constantly disposed in facets, even in those whose plumage is dull.

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* 8vo., Paris, 1832.

† Three species are recorded in the island of Juan Fernandez.

1st Race. The *Patagonians.*

Tail elongated, deeply forked; the *bill* rounded, long, expanded (renflé) at the extremity, very straight.

Obs.—The plumage is dull, brownish, with little brilliancy. The only known species inhabits South America.

Example, *Ornismya tristis*, Less. Locality, Chile. (*Trochilus gigas*, Vieill.)

2nd Race. The *Campylopterians* (*Campylopterus*, Sw.).

Wings with the shafts of their quill-feathers flattened, dilated, and bent, which gives the feathers a sabre-like curved or dolabriform disposition. Head without any tuft; the bill strong and slightly arched.

M. Lesson divides this race into two sections:

1. The Swallow-like Campylopterians.

Tail very long, deeply forked.

Example, *Ornismya hirundinacea* (*Trochilus macrourus*, Gm.).

2. The True Campylopterians.

Tail moderate, equal.

Examples, *Ornismya latipennis* (*Trochilus campylopterus*, Gm.); *Campylopterus ensipennis*, Sw., &c.

3rd Race. The *Velvet Humming-Birds* (*Les Sériceeux*—*Culampis*, Boie).

Tail moderate, equal or notched, bill a little recurved; form robust.

Example, *Trochilus auratus*, Less. (*Trochilus granatinus*, Lath.), &c.

4th Race. The *Ramphodons* (*Ramphodon*, Less.; *Heliotryx*, part, Boie).

Bill furnished with strong and serrated teeth. Two sections.

1. True Ramphodons.

Bill elongated, prismatic, straight, widened at the base, hooked at the point; *tail* rounded, the tail-feathers a little graduated.

Example, *Ramphodon maculatum*, Less. (*Trochilus nævius*, Dumont; *Trochilus squamosus*, Licht.).

2. The Sawbills.

Bill moderate, slightly recurved; tail a little notched in the middle, of a deltoïdal form.

Example, *Ornismya petasophora*, Less. (*Trochilus serrirostris*, Vieill.; *Trochilus jantinotus*, Natter.; *Trochilus petasophorus*, Wied.), and another.

5th Race. The *Avosets.*

Bill moderate, toothed on the edges of the mandibles, recurved upwards; *tail* moderate, rounded at the end.

Example, *Ornismya recurvirostris*, Less. (*Trochilus recurvirostris*, Sw.), and another.

6th Race. The *Caribs* (*Anthracothorax*, Boie).

Bill elongated, robust, recurved; tail moderate, rounded; a plastron before the neck.

Example, *Trochilis viridis*, Less, &c.

7th Race. The *Buffon Humming-Birds* (*Glaucis*, Boie).

Bill elongated, recurved; tail moderate, a little notched in the middle; no jugular plastron.

Example, *Trochilus Buffonii*, Less., &c.

8th Race. The *Brins-Blancs* (*Phæthornis*, Sw.).

Bill very long, very much arched; form elongated, delicate; *tail* with its feathers graduated; the two internal feathers exceeding the lateral ones.

Example, *Trochilus superciliosus*, Linn., &c.

9th Race. *The Topazes* (*Polytmus*, *Briss.*, Boie; *Lampornis*, Sw.).

Bill elongated, recurved; two long filaments in the tail of the male.

Example, *Trochilus pella*, Linn.

10th Race. *The Polytmi.*

Bill short, straight; the external tail-feathers terminated by two long filaments.

Example, *Ornismya cephalatra* (*Trochilus polytmus*, Linn.).

11th Race. *The Sapphos* (*Lesbia*, Less.).

Bill moderate, nearly straight; tail with its feathers very much graduated, wide, and deeply forked.

Example, *Ornismya Sappho*, Less. (*Trochilus sparganurus*, Shaw; *Trochilus radiosus*, Temm.; *Trochilus chrysurus*, Cuv.; *Trochilus chrysochloris*, Vieill.), &c.

12th Race. *The Clemences* (*Cœligena*, Less.).

Bill very long, very straight; form stout; *tail* moderate, hardly notched in the middle, or equal.

1st Tribe. The Mexicans.

No amethystine gorget.

Example, *Ornismya clemenciæ*, Less., &c.

2nd Tribe. The Corinnas.

Bill very long, straight: an amethystine gorget.

Example, *Ornismya mesoleuca*, Less, &c.

13th Race. *The Jacobins.*

Bill short, straight; tail ample or graduated.

Example, *Ornismya aurita*, Less. (Trochilus auritus, Vieill.), &c.

14th Race. *The Glaucopes* (*Mellisuga*, Briss., Boie).

Bill short, straight; tail forked.

Example, *Ornismya glaucopis*, Less. (*Trochilus glaucopis*, Gm.), &c.

15th Race. *The Lucifers.*

Bill elongated, recurved, delicate; *tail* forked; an amethystine or steel-blue gorget.

Example, *Ornismya cyanopogon*, Less. (*Cynanthus lucifer*, Sw.), &c.

16th Race. *The Racket-tails* (*Platures*, Less.).

Tail composed of acuminated feathers, the two external ones with shafts without barbs, and terminated by oval battledores (palettes).

Example, *Ornismya platura*, Less. (*Trochilus longicaudus*, Gm.; *Trochilus platurus*, Lath. Vieill.), and another.

17th Race. *The Emeralds* (*Basilinna*, Boie).

Bill elongated, straight; *tail* rounded, moderate: plumage emerald-green above and beneath, or mixed with white only.

Example, *Ornismya albirostris*, Less. (*Trochilus leucogaster*, Gm.; *Trochilus mellisugus*, Lath.), &c.

18th Race. *The Amazilis.*

Bill straight, moderate, reddish; plumage green above, white with ferruginous, or purple violet.

Example, *Ornismya amazili*, Less. (*Orthorhynchus amazili*, Less., Zool. de *la Coquille*), &c.

19th Race. *The Sephaniodes* (Stephanoides?),

Bill straight, delicate; head tufted; *tail* rounded; lower part of the body with rounded scales; head violet or sapphirine.

Example, *Ornismya sephaniodes*, Less. (*Mellisuga Kingii*, Vig.), and another.

20th Race. *The Tufts* (*Smaragdites*, Boie, part).

Bill very short, straight; a tuft terminated by a large, loose, gemmaceous blue or green plume.

Example, *Ornismya Delalandi*, Less. (*Trochilus Delalandi* and *Trochilus versicolor*, the latter the young, Vieill.), &c.

21st Race. The *Straight-tails* (*Heliactin*, Boie; *Cynanthus*, Sw., part).

Bill very short; *tail* composed of long, delicate, pointed, graduated feathers.

Example, *Ornismya chrysolopha*, Less. (*Trochilus cornutus*, Wied.; *Trochilus bilophus*, Temm.; *Trochilus Dufresnii*, female, and *Trochilus Pretrii*, young, Vieill.), &c.

22nd Race. The *Rubies* (*Calliphlox*, Boie).

Bill short, straight; an amethystine or ruby gorget; *tail* moderate.

1st Tribe. The Amethysts.

Throat amethystine-red.

Example, *Ornismya amethystina*, Less., &c.

2nd Tribe. The Rubies.

Throat ruby-red; body golden-green above.

Example, *Ornismya colubris*, Less. (*Trochilus colubris*, Linn.), and another.

3rd Tribe. The Sasins.

Throat ruby-red; body light-coloured (blond) above.

Example, *Ornismya sasin*, Less. (*Trochilus rufus*, Gm.; *Trochilus collaris*, Lath.; *Trochilus ruber*, Edw.).

4th Tribe. The Annas.

Throat ruby-amethystine; head the same.

Example, *Ornismya Anna.*

23rd Race. The *Topazes* (*Chrysolampis*, Boie).

Bill straight; *tail* rounded; head ruby-red; throat topaz.

Example, *Ornismya moschita*, Less. (*Trochilus mosquitus*, Linn.).

24th Race. The *Sapphires* (*Hylocharis*, Boie).

Plumage very golden-green, with a blue tone, or the throat azured; *tail* equal; *bill* small, delicate, straight.

Example, *Ornismya audeberti*, Less. (*Trochilus lucidus*, Shaw), and another.

25th Race. The *Blues* (Bleuets).

Bill short, straight, delicate; *tail* rounded; head and neck azure; tail green.

Example, *Ornismya Arsennii*, Less. (*Trochilus leucotis* (female), *Trochilus leucocrotaphus*, Vieill., (*Trochilus lucidus*, Shaw), and another.

26th Race. The *Gold-tails.*

Bill slightly recurved; *tail* with the feathers acuminated and of a brilliant red gold colour.

Example, *Ornismya Œnone*, Less., and another.

27th Race. The *Fops* (Coquets) (*Lophornis*, Less.; *Bellatrix*, Boie).

Bill short, aciculate, straight, delicate; feathers of the neck elongated into flabelliform ornaments (parures flabellées); tail moderate, rounded.

Example, *Ornismya ornata*, Less. (*Trochilus ornatus*, Gm.), &c.

Mr. Swainson sees in the Humming-Birds the full development of the suctorial perfection belonging to the *Tenuirostres*. The bill, he remarks, appears, from its soft and delicate structure, adapted for no other purpose than to protect a long, bifid, and flattened tongue, darted by the birds into the nectary of flowers, for the purpose of licking the honey. He observes that this tongue has been described as *tubular*, but that in all the Humming-Birds that he had examined the two filaments were perfectly flat; and so they might be consistently with the body of the tongue being a double tube: nor does Mr. Swainson say whether the specimens examined by him were recent, dry, or preserved in spirit. He adds that, like the rest of the tribe, the humming-birds are partly insectivorous, as he had personally ascertained, having repeatedly discovered minute flies in the stomachs of those he dissected.

The same zoologist observes that there is obviously a strong affinity between the Humming-Birds and the *Cinnyridæ*, although he is unacquainted with the precise link which connects the two; and that although the old authors not unfrequently confounded the two races, they are too distinct to be mistaken even by a modern student. 'The *Cinnyridæ*,' says Mr. Swainson in continuation, 'have full-sized legs, and their wings moderate and rounded: the Humming-Birds, on the contrary, have the feet excessively short and remarkably small; while the wings, for the size of their body, are frequently longer than those of the swallows. As the sunbirds are restricted to the tropical latitudes of Africa and India, so are the humming-birds confined to America: both groups are rich in species; and of this in particular the variety of secondary forms is almost innumerable. We have endeavoured to determine the five principal genera, but the subgenera can only be correctly ascertained by a much more rigid analysis than we have yet been able to make. In the genus *Trochilus*, as now restricted, we have all those whose bills are perfectly straight, the tail being either even or slightly divaricated. *Cynanthus* comprehends such species as have the bill slightly bent, with a tail very long and deeply forked. If we look to the sunbirds on the one hand, and to the hoopoes on the other, we immediately perceive that the straightness of the bill is a typical perfection of the humming-birds. In the genus *Lampornis* the bill is obviously much depressed at the base, and the tail is broad and even; while the type of the genus *Campylopterus* seems to be the recurved-billed humming-birds. Last of all comes the genus *Phæthornis:* hitherto the form of the tail has either been square, forked, or rounded; but in this group the tail is considerably and regularly graduated, the side-feathers very short, and the middle pair far exceeding all the others; the bill is not merely bent, but so much curved in the typical species as nearly to assume the form of a sickle. The gay and beautiful green which ornaments the upper plumage of all the groups here gives place to a brown colour, and even the throats of the male birds are destitute of ornament. The genus *Phæthornis*, in fact, obviously represents the rasorial type, and is a miniature likeness of the hoopoes, or that family with which we began our survey of the *Tenuirostres*.' (*Classification of Birds*, 1837.)

In the *Synopsis* of the same work Mr. Swainson gives the following arrangement and definitions, observing that the typical characters alone are given of what he considers to be the primary groups; but as the circular succession of the subgenera in each is a subject which requires more investigation than he had been able to give it, he will not attempt to impose names upon the minor groups, which could not as yet be properly demonstrated.

Family *Trochilidæ*. Humming-Birds.

Wings excessively long, falcated. Feet very small.

Genera.

Lampornis, Sw.—*Bill* straight, or very slightly bent, generally pale, considerably depressed for its whole length, but more especially at the base. *Wings* reaching to the end of the *tail*, which is short and even.

Example, *Lampornis mango.*

Trochilus, Auct.—*Bill* very straight, long, cylindrical, or rather broader than high. *Tail* generally even, but sometimes slightly forked.

Example, *Trochilus longirostris.*

Cynanthus, Sw.—*Bill* cylindrical, more or less curved. *Tail* forked.

Example, *Cynanthus forficatus.*

Phæthornis, Sw.—*Bill* considerably compressed, generally curved from the base. *Tail* graduated, or cuneated. Colours less brilliant. The Rasorial type.

Example, *Phæthornis superciliosus.*

Campylopterus, Sw.—*Bill* curved. Shafts of the quills dilated. *Tail* graduated.

Example, *Campylopterus recurvirostris.*

Such is Mr. Swainson's arrangement. The *Trochilidæ* are placed by him between the *Cinnyridæ* and the *Promeropidæ*.

The Prince of Canino, in his 'Specchio Comparativo' (1827), places the family *Anthomyzi*, with the genus *Trochilus*, between the familes *Tenuirostres* and *Ægithali*. In his 'Birds of Europe and North America' (1838) the *Trochilidæ* are arranged between the *Upupidæ* and the *Certhidæ*, and comprise the genera *Trochilus*, *Lampornis*, and *Calliphlox*.

Mr. G. R. Gray (*List of the Genera of Birds* (1840)) gives the *Trochilidæ* a place between the *Nectarinidæ* and the *Meliphagidæ*, making the first-named family consist of the following subfamilies and genera:—

Subfam. 1. Lamporninæ.

Genera:—*Campylopterus*, Sw.; *Eulampis*, Boie; *Petasophora*, G. R. Gray; *Lampornis*, Sw.; *Glaucis*, Boie; ——? (*Chrysures*, Less.); *Topaza*, G. R. Gray; *Calothorax*, G. R. Gray (*Lucifers*, Less.).

Subfam. 2. Phœthorninæ.

Genera:—*Grypus*, Spix; *Phæthornis*, Sw.

Subfam 3. Trochilinæ.

Genera:—*Patagona*, G. R. Gray (*Patagones*, Less.); *Cæligena*,[*] Less.; ——? (*Glaucopes*,[†] Less.); *Lesbia*, Less.; *Heliactin*, Boie; *Trochilus*, Linn.; *Heliothryx*, Boie; ——? (*Platurus*, Less.); ——? (*Avocettes*, Less.); *Polytmus*, Briss.; *Amizilis*, Less.; *Sephanoides*, Less.; *Orthorhynchus*, Cuv.; *Mellisuga*, Briss.; *Chrysolampis*, Boie; *Hylocharis*, Boie; *Lophornis*, Less. (*Bellatrix*, Boie; *Coquets*, Less.).

In the last edition of this useful publication (1841) the same arrangement is followed.

The number of species recorded by M. Lesson in his general index to the *Trochilidées* is one hundred and ten.[‡] Mr. Bullock, so long ago as 1824, stated that in his former collection there were near a hundred species; and he adds, 'every day brings us acquainted with more.'[§]

Mr. George Loddiges now (1842) possesses one hundred and ninety-six species, and some of his stores are not yet examined. This collection, the finest in Europe, affords all the materials for a complete history of the family; for not only is it rich in species and varieties, but in examples of their different states of plumage according to sex or age, including many nests with their contents. A great number are set up by the ingenious possessor in the most lifelike manner, and in a style peculiarly his own. He has studied the subject deeply, and no one is so competent as he is to present zoologists with a satisfactory arrangement. Here may be seen every form of bill—curved, even to an adunc downward curvature, recurved, very long and subrecurved, straight, very short, sharp, and straight;—and every variety of ear-appendages, frills, ruffs, crests, tails, and feathered boots.

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[*] This name comes very near to *Cælogenys*.

[†] Mr. G. R. Gray observes that this name had been previously employed in zoology.

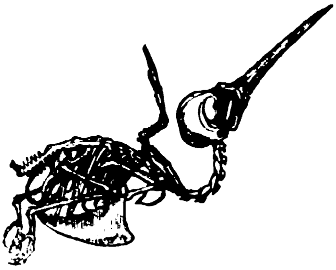
[‡] The Harlequin, L'Oiseau mouche arlequin, Less., *Trochilus multicolor*, Lath., figured and described with doubt by M. Lesson from Edwards's figure, is no species. The specimen is made up from the skins of Parrots, &c.

[§] *Six Months in Mexico*, 8vo.

ORGANIZATION.

An observer who gazes on an assemblage of humming-birds is struck, as soon as his dazzled eyes become so far accustomed to the gorgeous spectacle as to permit the exercise of his sober judgment, with the great development of the wings in all the species, from the Patagonian humming-bird to the smallest epitome of feathered creation among them, and the extreme smallness of the feet. If he examines the skeleton of one of these minute birds, this observation becomes, if possible, strengthened. The very deep keel of the sternum, the power of the bones of the wing, the lengthened scapula, and the comparatively impoverished structure of the lower extremities, all exhibit an organization of the locomotive system especially adapted to the development of the highest powers of flight.

To put this framework in motion a corresponding development of the muscular system is applied. The enormous—for enormous, by comparison, they are—pectoral muscles, and the other muscles employed for working the wings, form nearly the whole fleshy substance of the bird: those allotted to the feet are reduced to the least possible quantity consistently with the requisite stability. All proclaims that the being before us is destined to pass the most active part of a highly active life in the air; and when we proceed to inquire into the habits of this ethereal race, we shall at once perceive how admirably adapted to those habits this organization is.

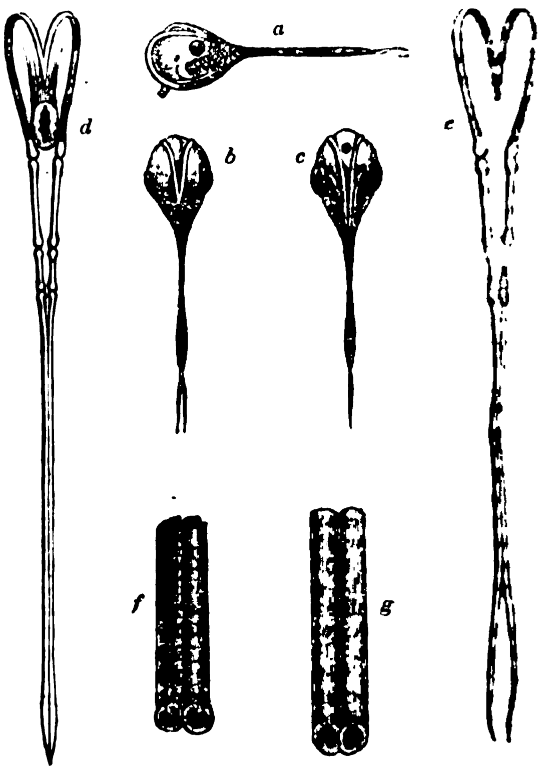


Skeleton of Humming-Bird (from a specimen in the museum of the Royal College of Surgeons in London, by permission).

In the Physiological Series of the museum of the Royal College of Surgeons, No. 282 c, is the preparation of a humming-bird with the wings extended and the pectoralis muscle of one side exposed, which, in this genus, is remarkably powerful, and the keel of the sternum proportionably deep. Professor Owen remarks that the first primary or digital quill-feather, as in all birds of great powers of flight, is the longest. (*Cat.*, vol. i.)

Another part of the mechanism of these minute creatures, intimately connected as it is with their existence, demands some notice. The tongue is the principal organ for obtaining the food, which consists of the honied juices of flowers and insects. This tongue is so framed that, like the same organ in the WOODPECKERS, it can be darted out of the bill by a sudden action of the os hyoides, comparable to that of a spring suddenly released from the detent. It is very long, and can be protruded a good way from the bill. M. Lesson describes it as composed of two musculo-fibrous cylinders soldered to each other, something after the fashion of a double-barrelled gun, throughout a great portion of their continuity, and separated towards the point of the tongue; so that the two tubes, slightly enlarged towards this part, separate from each other, and each presents a little blade, which is concave within and convex externally.

In order that this tubular tongue may be thus projected upon the aliments which its terminations are appointed to seize and retain, the os hyoides which supports it is formed of two bony plates which separate, pass below the cranium, re-ascend over the bones of the occiput, and proceed to form a point of resistance, or fulcrum, by their reunion on the forehead. The result of this disposition, when brought into play by the muscles of the tongue, is a great power over the muscular tubes, furnished with circular fibres, which compose the organ of taste. The two small blades, or elongated spoon-like terminations, seize the insects, or lick up the honied exudations, which are on the instant carried to the aperture of the œsophagus by the elasticity and contractility of the two tubes, and forthwith swallowed. The long and slender bill comes admirably in aid to insert the tongue into the nectaria of flowers.



Bill and tongue of Humming-bird.

a, the head, profile; the tongue protruded from the bill and showing its bifurcation: the two branches of the os hyoides are seen surrounding the cranium; *b*, the same seen from above, the two branches of the os hyoides uniting at a pointed angle in front; *c*, the same seen from below; *d*, the tongue much magnified, with some of its soft parts dissected away, but adhering to the hyoides and its branches, as well as to the larynx, seen from above; *e*, the same seen from below, with the os hyoides only, and the two lamellæ of its point separated; *f*, portion of the tongue very much magnified, seen from above, so as to convey the idea of the manner in which the cylinders that form it are united; *g*, the lower side of the same. (Lesson.)

Sir William Jardine confirms this, which was also Brisson's view of the structure, as far as the examination of the moistened parts would allow; but he adds, that his own examination of the tongue of *Trochilus moschitus*, relaxed with warm water, gave the appearance of a fimbriated opening at the tip, having the exterior margin of each fork set with recurved, sharp-pointed, pliable spines, as if to assist its viscidity in securing any substance seized by them. (*Naturalist's Library:* 'Ornithology,' vol. i.)

The sight of the humming-birds is well developed, and very acute within the range required ordinarily for its exercise: the sense of hearing is quick.

The plumage in which these dazzling birds are clad defies description either with pen or pencil. The most brilliant metallic tints, the hues of the richest gems, fade before the display made by many of the living adult males. 'Splendet ut sol,' says Marcgrave, speaking of one of them. Audebert applied himself to account for this brilliancy of colour, and to demonstrate on mathematical principles that it is due to the organization of the feathers, and to the manner in which the luminous rays are reflected on falling upon them. M. Lesson thinks that this colour is, first, the result of the elements contained in the blood and elaborated by the circulation; and that, secondly, the texture of the plumes plays the principal part in consequence of the manner in which the rays of light traverse them, or are reflected by the innumerable facets which a prodigious quantity of barbles or fibres present. All the scaly feathers, in fact, he observes, which simulate velvet, the emerald, or the ruby, and which one sees on the head and the throat of the *Epimachi*, the Paradise-birds, and the Humming-birds, resemble each other in the uniformity of their formation; all are composed of cylindrical barbles, bordered with other analogous regular barbles, which in their turn support other small ones, and all of them are hollowed in the centre with a deep furrow, so that when the light, as Audebert first remarked, glides in a vertical direction over the scaly feathers, the result is, that all the luminous rays are absorbed in traversing them, and the perception of black is produced. But it is no longer the same when the light is reflected from these feathers (each of which performs the office of a reflector); then it is that the aspect of the emerald, the ruby, &c., varying with the utmost diversity under the incidences of the rays which strike them, is given out by the molecular arrangement of the barbles. As an example of the diversity of tints which spring from such scaly feathers, M. Lesson cites the emerald 'cravat' of many species, which takes all the hues of green, and then the brightest and most uniformly golden tints down to intense velvet black; or that of ruby, which darts forth pencils of light, or passes from reddish orange to a crimsoned red-black.

Mr. Bullock, in his *Six Months in Mexico* (1824), speaking of the humming-birds, says, 'Europeans who have seen only the stuffed remains of these little feathered gems in museums have been charmed with their beautiful appearance; but those who have examined them whilst living, displaying their moving crests, throats, and tails, like the peacock in the sun, can never look with pleasure on their mutilated forms. I have carefully preserved about two hundred specimens, in the best possible manner, yet they are still but the shadow of what they were in life. The reason is obvious; for the sides of the laminæ or fibres of each feather, being of a different colour from the surface, will change when seen in a front or oblique direction; and as each lamina or fibre turns upon the axis of the quill, the least motion, when living, causes the feathers to change suddenly to the most opposite hues. Thus the one from Nootka Sound changes its expanded throat from the most vivid fire colour to light green; the Topaz-throated does the same; and the Mexican Star changes from bright crimson to blue.'

The females generally speaking are without the splendour of the males; and are clad in modest, not to say sombre, plumage. The same may be said of the young males till the second year, when traces of the future brilliancy begin to appear here and there; but on the third year all remains of the sober livery of youth have vanished, and the bird shines out in the full radiance of his nuptial dress.

The small feet are generally of a dark colour: several species, especially those which live high up in the mountainous regions, have the tarsi warmly and largely protected with white plumelets, so that the birds look as if they had downy muffs on their legs.

NATURAL HISTORY, &c.

Before we proceed to a consideration of the habits of this splendid family, it becomes necessary to notice both the scientific and vernacular names by which they have been distinguished.

It is to be regretted that Linnæus selected for the generic designation of this group an antient name, doubtful in itself, but which by no possibility could have been applied to a form restricted to the New World. That Aristotle has described two distinct birds under the name of τροχίλος (*Trochilus*) can hardly be denied.

The *Trochilus* of the eleventh chapter of the ninth book (*Hist. Anim.*), called πρέσβυς and βασιλεύς ('antient' and 'king'), appears, from the description of its habits, to belong to our Wrens. But whether the name was intended to designate the common European Wren or the Golden-crowned Wren has been doubted. Belon (*L'Histoire de la Nature des Oiseaux*, 1555) is of opinion that the name was applied to the common Wren. 'The Greeks,' says he, 'antiently named it *Trochylos*, *Presvis*, or *Basileus*, and the Latins *Trochylos*, *Senator*, *Regulus*. They call it also *Cladorhinchus*, which is the bird they say enters the mouth of the crocodile to pick his teeth.' Above the cut, which cannot be mistaken for the representation of any other bird than the common Wren, is printed '*Trochilus*, *Cladorhinchus*, *Presvis* et *Basileus* en Grec, *Rex avium*, *Senator*, et *Regulus* en Latin, *Roytelet*, *Bœuf de Dieu*, et *Berichot* en François.' Beneath the figure is printed the passage in Aristotle above alluded to (book ix., ch. 11). In the *Portraits d'Oyseaux, Animaux, Serpens, Arbres, Hommes et Femmes d'Arabie et Egypte, observez par P. Belon du Mans* (1557), which contains the same cuts of birds as the *Histoire*, the following is the superscription above the cut of the common Wren: 'Grec., τροχιλος; Latin, *Regulus*, *Trochilus*, *Rex*, *Senator*, *Basiliscus*; Italien, *Reillo*, *Regillo*, *Rectino*, *Reatin*, *Fiorracino*; François, *Roytelet*, *Beuf de Dieu*, *Berichot*, *Roy Bertaud*.' Belon is further of opinion that the Golden-crowned Wren is the τύραννος (*Tyrannus*) of Aristotle (*Hist. Anim.*, viii. 3). Ray on the other hand considers the 'Golden-crowned Wren, *Regulus cristatus*, Aldrov.,' to be the *Trochilus* of Pliny and Aristotle, and the *Presbys* and *Basileus* of the latter. But Pliny apparently confounds the two *Trochili* of Aristotle, for he says (*Nat. Hist.*, viii. 35) that the *Trochilus* which enters the crocodile's mouth is a little bird, called in Italy the King of Birds. Again, he enumerates among the birds which are inimical to each other (*Ibid.*, xi. 64), the Eagle and the Trochilus (*si credimus*) because the latter is called 'Rex avium.'

The other *Trochilus* of Aristotle, that which enters the crocodile's mouth and is suffered to depart without injury (*Hist. Anim.*, ix. 6), appears to be the *Trochilus* mentioned by him in the 3rd chapter of the eighth book, and which he associates with the Halcyons, both species of which have a cerulean or sea-coloured back (κυανοῦν). This *Trochilus* seems to be identical with that bird on the banks of the Nile mentioned by Herodotus, which enters the mouth of the crocodile to search for leeches that have there attached themselves, and which Geoffroy St. Hilaire seems to have made out to be the *Saq-saq* of the Arabs, the *Charadrius Ægyptius*, or 'Egyptian Dotterell,' of Hasselquist, which closely approximates to our European *Little Ring-Dottrell* (*Charadrius minor*, Meyer).

Under such circumstances it would have been much better for Linnæus to have adopted the generic name of Brisson, *Mellisuga*, instead of the entirely inapplicable *Trochilus*; but this Linnean term is now so generally acknowledged among zoologists as the designation of the Humming-Birds, that it is too late to propose an alteration which would only produce confusion; and we regret to state that this is by no means a solitary instance of the misapplication of antient Greek names to animals exclusively belonging to America and its islands.

We have seen the numerous races into which M. Lesson has subdivided the Humming-Birds in his *General and Synoptical Index of the Birds of the genus Trochilus* (1832); but in the volume which treats of the *Natural History of the Colibris*, he expresses his opinion that only three races can be reasonably recognised, namely, the *Ornismyæ*, or *Oiseaux Mouches* (Fly-Birds), the *Ramphodons*, and the true *Colibris*.

The term *Colibri*, according to Buffon, is a Caraib word, and is written in old accounts *Colibri*, or *Colubri*; but M. Lesson would rather derive the word from the old French *col brillant*, expressive of the beautiful changeable reflections of the throat-feathers, which may have been transformed into *Colibri* or *Colubri* by the negroes of the islands, unless it may be supposed to be the diminutive of the Latin word *Coluber*, expressive of those same ever-changing reflections with which their plumage shines. *Courberi*, according to Sonnini, appears to be the name by which they are known to the Garipous of Guiana.

The native names of the Humming-Birds were, as might be expected, first made known by the Spaniards and others who first invaded the New World. With the antient Mexicans these bright creatures appear to have been great favourites. The radiant mantles worn by the natives in Montezuma's time glittered with the spoils of these diminutive birds, which were also employed in the art of design, and in the composition of those embroidered pictures which Cortes has so highly praised. Humboldt notices the religious belief of the Mexicans that Toyamiqui, the spouse of the God of War, conducted the souls of those warriors who had died in defence of the gods into the mansion of the sun and transformed them into Humming-Birds; and it must be owned that they form an emblem of the soul hardly less spiritual than the butterfly of the Greeks. Hernandez treats of the Mexican species under the names of *Hoitzitziltototl*, or *Avis varia*; and in the *Nova Plantarum, Animalium, et Mineralium Mexicanorum Historia à Francisco Hernandez Medico in Indiis praestantissimo primum compilata, dein à Nardo Antonio Reccho in Volumen digesta*, &c. (Romæ, 1651, folio), we find seven species figured under the general title of *Hoitzitzil*, and the specific designations of *Xiu hoitzitzilin*, *Etsal hoitzitzilin*, *Ystac hoitzitzilin*, *Tenoc hoitzitzilin*, *Quetsal hoitzitzilin*, *Tozcacoz hoitzitzilin*, and *Xoe hoitzitzilin*. Ximenes writes the word *Huitzitzil*. Gomara gives *Vicicilin* as the name. John de Laet writes *Quenti* as the Peruvian and *Tomineios* as the Spanish appellation. *Ourissia* is the name recorded by Nieremberg; and *Guianumbi*, according to Marcgrave and others, is the Brazilian designation. These and other Indian terms are said to signify *rays of the sun, tresses of the day-star, murmuring birds*, and the like. The Spanish *Tominos* or *Tomineios* seems to refer to their diminutive size and small weight;[*] and *Picaflores*, another term employed by the Spanish or Portuguese creoles, to their mode of taking their food. The late Captain Lyon, R.N., in his *Journal of a Residence and Tour in the Republic of Mexico* (1828), states that in the neighbourhood of Xalapa the Humming-Bird is distinguished by the names of *Chupa-rosa* and *Chupa-myrta*, 'Rose-sucker' and 'Myrtle-sucker.'

Habits, Food, Nest, &c.—It is not to be wondered at that fable should have its share in accounting for the origin and describing the habits of these diminutive aërial beings. Thus, while the more sober believed that they were hatched from eggs like other birds, others fancied that they were transformed from flies, some going so far as to declare that they had been seen in the half-fly half-bird state. Then again they were supposed to live no longer than the flowers which afforded them food, and when those flowers faded they were believed to fix themselves by the bill to some pine or other tree, and there remain during the dreary months till the descending rains brought back the spring, when they revived again, to undergo the same alternation of life and death. Gomara states that they expired in the month of October, having previously suspended themselves by their feet from a branch in some warm place, and were renascent in April. Instances were cited where they had been kept affixed to some stick within doors, and after lying lifeless for six months, had become reanimated, and being given their liberty, had flown forth into the fields. This is related as worthy of all credit in the edition of Hernandez above quoted (Romæ, 1651, p. 322, folio). John de Laet quotes Ximenez for the story of their remaining affixed by their bills, and there remaining immoveable, like dead birds, for six months, till, the rains returning, Flora again decked the fields. (*Novus Orbis*, &c., folio, Lugd. Batav. (Elzevir), 1633, p. 256.)

Humming-Birds were in the museum of the Tradescants under that name, the origin of which we shall presently see: in the *Musæum Tradescantianum*, by John Tradescant (12mo., London, 1656), we find in the catalogue of *Whole Birds*, 'divers Humming-Birds, three sorts whereof are from Virginia.' It may be interesting, with reference to the fables above mentioned, to give an instance of the power of these birds to brave the wintry weather. Captain Phillip King, R.N., saw one at Tierra del Fuego under such circumstances. 'It has been mentioned,' says he, 'that we found many humming-birds at Port San Antonio, which we attributed to the sheltered situation of the place, and the luxuriant growth of fuchsias and other plants upon the sweets of whose flowers they feed. Here however one of the same species was seen sporting about in a most exposed place and during the falling of a snow-shower, a proof of the hardy character of this little bird, which, if it does migrate upon the approach of winter to a warmer climate, lingers, at least, as long as it possibly can. This was the middle of April; the winter had, in fact, already commenced, and all the mountains round us were clothed with snow, while the ground was also coated with the same dazzling covering.' (*Voyages of the Adventure and Beagle*, vol. i.) The bird here seen was the *Mellisuga Kingii*, which, Mr. Darwin observes, is found over a space of 2500 miles on the west coast, from the hot dry country of Lima to the forests of Tierra del Fuego.

We will now turn to the record of a very acute zoological observer who had especially turned his attention to this lovely race. Mr. Bullock (after observing that though it abounds more in the warm regions, it is dispersed over every part of America and its islands, in almost every climate, for it is found in the summer months in Hudson's Bay and Canada) remarks that Captain Cook brought many fine specimens from Nootka Sound. He himself added several new species from the temperate table-land of Mexico, and the woods in the vicinity of the snow mountains of Orizaba, Popocatepetl, &c. In Jamaica he procured the smallest known, which, he remarks, is considerably less than some of the bees. 'The first I ever saw alive of these minute creatures,' says Mr. Bullock, 'was in the yard of the house of Mr. Miller in Kingston, Jamaica. He had taken his station on the twig of a large tamarind-tree, which was close to the house and overspread part of the yard: there, perfectly indifferent to the number of persons constantly passing within a few yards, he spent most of the day. There were few blossoms on the tree, and it was not the breeding season, yet he most pertinaciously kept absolute possession of his dominion: for the moment any other bird, though ten times as large as himself, approached near his tree, he attacked it most furiously, and drove it off, always returning to the same twig he had before occupied, which he had worn quite bare of leaves for three or four inches by constantly perching on it. I often approached within a few feet, with pleasure observing his tiny operation of dressing and pluming, and listening to his weak, simple, and often-repeated note. I could easily have caught him, but was unwilling to destroy so interesting a little visitant who had afforded me so much pleasure. In my excursions round Kingston I procured many of the same species, as well as the long-tailed black and a few others; and especially the one I have mentioned as the smallest yet described, but which has the finest voice of any. I spent some agreeable hours in the place that had been the Botanical Garden of Jamaica, and on the various trees now growing to a luxurious size met with many curious birds, among which this specimen was perched on the highest branch of the bread-fruit or cabbage-tree. He poured forth his slight querulous note among a most curious assemblage of the valuable indigenous and exotic plants and trees of the island, on a spot once the pride of Jamaica, but now a deserted wilderness.' (*Six Months' Residence and Travels in Mexico*, 1824.)

The expressions in this interesting description relative to the voice of the Humming-Birds bring us to the question whether they sing. Jonston remarks that none of the Spanish authors make mention of any song: but that the French alone, 'Levius et Theretus' (Thevet and Jean de Léry are probably meant), declare that they do sing, nay, that they are so assiduous in song, that no one who had not seen and heard them would believe that so sweet and sublime a song could proceed from such a diminutive body. Buffon likens their small cry frequently repeated to the syllables *screp, screp;* and Vieillot, with much more truth, according to M. Lesson, to those of *tère, tère*, articulated with more or less force, and most ordinarily in a sharp tone. M. Lesson says that the *Oiseaux-mouches* do not appear to have any song. It is, he remarks, principally in going from one place to another that the cry above alluded to is excited, and most frequently they are completely dumb. He declares that he has passed whole hours in observing them in the forests of Brazil, without ever having heard the slightest sound proceed from their throats. We have heard it however asserted that the *Cora Humming-bird* sings. The truth may be that there are both dumb and vocal species among so great a multitude of *Oiseaux-mouches* and *Colibris* exhibiting such varieties of form and colour.

Mr. Darwin, like many others, was struck with the similarity of their flight and habits to that of the sphinxes. He relates that he started early and walked to the Gavia, or topsail mountain in the neighbourhood of Bahia. 'The air was delightfully cool and fragrant; and the drops of dew still glittered on the leaves of the large liliaceous plants, which shaded the streamlets of clear water. Sitting down on a block of granite, it was delightful to watch the various insects and birds as they flew past. The humming-birds seem particularly fond of such shady retired spots. Whenever I saw these little creatures buzzing round a flower, with their wings vibrating so rapidly as to be scarcely visible, I was reminded of the sphinx moths: their movements and habits are indeed in many respects very similar.' (*Journal*.) Mr. Bullock speaks of them when caged, as remaining as it were suspended in the air, in a space barely sufficient for them to move their wings, and observes that the humming noise proceeds entirely from the surprising velocity with which they perform that motion, by which they will keep their bodies in the air apparently motionless for hours together. Wilson says that when they are thus poised or suspended, their wings become invisible or only like a mist. No one has described their flight more elegantly and accurately than Buffon:—'The vibration of the wings is so rapid that the bird poised in the air appears not only immoveable, but entirely without action. It is seen to stop thus for some instants before a flower and dart off like a gleam to another: it visits them all, plunging its little tongue into their bosom, caressing them with its wings, without ever settling, but at the same time never quitting them.' To the noise thus occasioned they not only owe the name by which we designate them, but also the epithets of *murmures*, *bourdons*, and *frou-frous*, by which they are distinguished by the Creoles of the Antilles and Cayenne.

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[*] Tomin, the third part of a drachm, Spanish troy weight.

Mr. Darwin (*loc. cit.*) states that two species are common in Chile, and that he has seen a third within the Cordillera at an elevation of about 10,000 feet. He adds that in the wooded island of Chiloe, which has an extremely humid climate, *Mellisuga Kingii* skipping from side to side amidst the dripping foliage is perhaps more abundant than any other kind. It there very commonly frequents open marshy ground, where a kind of bromelia grows: hovering near the edge of the thick beds, it every now and then dashed in close to the ground; but Mr. Darwin could not see whether it ever actually alighted. At the time of year referred to by him there were very few flowers, and none whatever near the beds of bromelia. Hence he was quite sure they did not live on honey; and on opening the stomach and upper intestine, by the aid of a lens he could plainly distinguish, in a yellow fluid, morsels of the wings of *diptera*, probably *tipulidæ*. It is evident, he observes that these birds search for minute insects in their winter-quarters under the thick foliage. He opened the stomachs of several specimens, which were shot in different parts of the continent; and in all remains of insects were so numerous as often to present a black comminuted mass, as in the stomach of a creeper. Mr. Darwin goes on to state that in Central Chile these birds are migratory, making their appearance there in autumn, and that in the latter end of the month corresponding to our October they were very common. They began to disappear in the spring, and on the 12th of what would correspond to our March he saw, in the course of a long walk, only one individual. As this species migrates to the southward, it is replaced by the arrival of the larger kind presently to be noticed. Mr. Darwin does not believe that the small kind breeds in Chile, for during the summer their nests were common to the south of that country. He refers to Humboldt's *Personal Narrative*, Cook's *Third Voyage*, and Beechey's *Voyage*, and remarks that the migration of the humming-birds on both the east and west coast of North America exactly corresponds to what takes place in the southern continent. In both cases, he observes, they move towards the tropic during the colder parts of the year, and retreat northward before the returning heat. Some however, he adds, remain during the whole year in Tierra del Fuego, and in Northern California, which he remarks, in the northern hemisphere, has the same relative position which Tierra del Fuego has in the southern, and he quotes Beechey for the fact that some remain.

Numbers of the large species (*Trochilus gigas*) arrived in the neighbourhood of Valparaiso, during the year in question, a little before the vernal equinox. Mr. Darwin describes it as coming from the parched deserts of the north, probably for the purpose of breeding in Chile, and says that when on the wing its appearance is singular. He observes that, like others of the genus, it moves from place to place with a rapidity which may be compared to that of *Syrphus* among *Diptera* and *Sphinx* among moths; but, whilst hovering over a flower, it flaps its wings with a very slow and powerful movement, totally different from that vibratory one common to most of the species which produces the humming noise. He declares that he never saw any other bird where the force of its wings appeared (as in a butterfly) so powerful in proportion to the weight of its body. He tells us that when hovering by a flower, its tail is constantly expanded and shut like a fan, the body being kept in a nearly vertical position. This action, he says, appears to steady and support the bird, between the slow movements of its wings. He further states that although flying from flower to flower in search of food, its stomach generally contained abundant remains of insects, which he suspects are much more the objects of its search than honey; and that its note, like that of nearly the whole family, is extremely shrill.

Mr. Bullock saw one in the act of preying upon insects. 'The house I resided in at Xalappa for several weeks, on my return to Vera Cruz, was,' says that enterprising naturalist, 'only one story high, inclosing, like most of the Spanish houses, a small garden in the centre, the roof projecting six or seven feet from the walls, covering a walk all round, and leaving a small space only between the tiles and the trees which grew in the centre. From the edge of these tiles to the branches of the trees in the garden the spiders had spread their innumerable webs so closely and compactly that they resembled a net. I have frequently watched with much amusement the cautious peregrination of the humming-bird, who, advancing beneath the web, entered the various labyrinths and cells in search of entangled flies, but as the larger spiders did not tamely surrender their booty, the invader was often compelled to retreat: being within a few feet, I could observe all their evolutions with great precision. The active little bird generally passed once or twice round the court, as if to reconnoitre his ground, and commenced his attack by going carefully under the nets of the wily insect, and seizing by surprise the smallest entangled flies, or those that were most feeble. In ascending the angular traps of the spider great care and skill was required; sometimes he had scarcely room for his little wings to perform their office, and the least deviation would have entangled him in the complex machinery of the web, and involved him in ruin. It was only the works of the smaller spiders that he durst attack, as the largest rose to the defence of their citadels, when the besieger would shoot off like a sunbeam, and could only be traced by the luminous glow of his refulgent colours. The bird generally spent about ten minutes in this predatory excursion, and then alighted on a branch of an avocata to rest and refresh himself, placing his crimson star-like breast to the sun, which then presented all the glowing fire of the ruby, and surpassed in lustre the diadem of monarchs.' The species whose evolutions are here described appears to have been that called by Bullock the Mexican Star, *Cynanthus lucifer*, Sw. (*Ornismya cyanopogon*, Less.).

The nests of these birds are as wonderful as any that are made. They vary greatly in form and structure; but

Nest of Humming-Bird. (Lesson.)

Nest of Humming-Bird with eggs. (Lesson.)

in all the soft and delicate materials are so put together as to furnish as much warmth as possible, an object of first-rate importance where the body of the parent, generally speaking, is so small, and the quantity of animal heat given out must be in proportion.

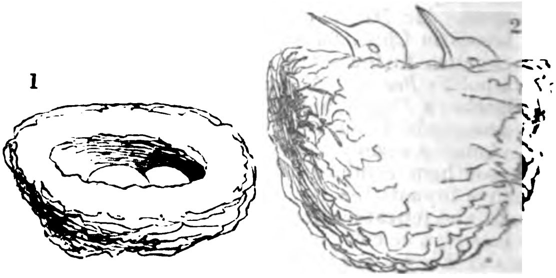
Prince Maximilian de Wied, on examining the flower of a palm-tree in Brazil, found affixed to it the nest of the blue-headed humming-bird (*Trochilus pileatus*, *Ornismya cristata*, Less.?), which, he says, much resembles that of the *Trochilus bicolor* of authors. He found it as well covered with moss as those of the Goldfinch and many other small European birds. The Prince adds, that in all humming-birds' nests two white eggs of an elongated form are found, which in some species are extraordinarily small. This rule as to the duality of the eggs is not without exception, if the information given to Sir William Jardine be correct, that the Doctor Humming-Bird, as it is provincially termed (*Trochilus hirsutus*), builds its nest suspended like that of the Yellow-tail (*Cassicus cristatus*) with the entrance somewhat downwards, and lays only one egg. This nest is described as being of a lengthened form, composed of dried grass and slender roots, moss, &c., as not of the general compact structure, and as suspended from the leaf of some reed-like plant, to which it is cemented chiefly by the threads of spiders or caterpillars.

Cotton, thistle-down, delicate fibres, a fungus-like substance, and other soft materials woven into a compact and fleecy substance, enter into the composition of the nests of Humming-birds. The outside is in most instances covered with lichens, generally supposed to be stuck on with a sort of glue secreted by the bird; but we have reason to believe that this is not so. The nest, generally, appears to be made by warping spiders' webs over fragments of plants, their down, lichens, &c.; and the lichens, which are never turned the wrong way, are secured by the webs only.

Sir W. Jardine, in the *Naturalist's Library: Humming-Birds*, vol. ii., gives the following interesting account of the manner of building of one of the species, related to him by Mr. Kirk, a resident in the island of Tobago:—'The Ruby Humming-Bird,' says Mr. Kirk, writing from that island, 'makes its appearance here on the 1st of February. Some say it is found in the leeward part of the island all the year; others, that it arrives earlier by a month to the windward: the latter, I think, more probable. Certain I am that there is no individual in the island who takes so much exercise in the woods as I do; and I can positively say, that since the 1st of August last, and perhaps some time previous, until the 1st of February, I have not seen one of these birds; and now (1st March) they are abundant. They begin to make their nests about the 10th of February. I know now of several containing two eggs each, and watched one yesterday for nearly an hour. Her manner of construction was very ingenious: bringing a pile of small grass or lichen, she commenced upon a small twig, about a quarter of an inch in diameter, immediately below a large leaf, which entirely covers and conceals the nest from above, the height from the ground being about three feet. After the nest had received two or three of these grasses, she set herself in the centre, and putting her long slender beak over the outer edge, seemed to use it and her throat much in the same way as a mason does his trowel, for the purpose of smoothing, rubbing to and fro, and sweeping quite round. Each visit to the nest seemed to occupy only a couple of seconds, and her absence from it not more than as many minutes. In a few hours after I saw the nest, which had all the appearance of a finished one. I expect to find an egg there to-day.'

Nest of the Brazilian Amethyst Humming Bird (*Ornismya amethystoides*, Less.). *a*, the egg.

Such are only a few of the forms of these cradles: many of them are proofs of a sagacity beyond instinct. Thus some have been seen hanging evenly balanced on a single tendril, of a somewhat uncouth shape, bulging out on the side opposite to that where the bird sat, and loaded so as to form a counterpoise to the bodies of the parent and young. In another such nest small stones were placed at the counterbalancing end. Another nest, on which there were feathers externally, hung from a rock secured by two suspensory bands. But the late lamented Captain Lyon, R. N., whose accuracy as an observer is well known, gives a very extraordinary account of the adaptation of the labours of the bird to the exigency of the case, in a letter to a friend in England, dated Gongo Soco, Brazil, 17th March, 1829:—'I am too closely confined here,' says Captain Lyon, 'and too constantly occupied to attend much to Natural History or to anything except the mines; but it may interest you to have an account of some young Humming-birds whose hatching and education I studiously attended, as the nest was made in a little orange-bush by the side of a frequented walk in my garden. It was composed of the silky down of a plant, and covered with small flat pieces of yellow lichen. The first egg was laid January 26th, the second on the 28th, and two little creatures like bees made their appearance on the morning of February 14th. As the young increased in size, the mother built her nest higher, so that from having at first the form of figure 1, it became ultimately like figure 2.



'The old bird sat very close during a continuance of the heavy rain for several days and nights. The young remained blind until February 28th, and flew on the morning of March 7th without previous practice, as strong and swiftly as the mother, taking their first dart from the nest to a tree about 20 yards distant. (*Zool. Journ.*, vol. v., p. 1.) This is the only instance known to us of such post-nascent nest-building; and it is not impossible that the parent might have laid her eggs in an old nest which she perceived to be too shallow to contain her young in security. Still the context would lead to the conclusion that the nest was begun under Captain Lyon's eye; and he was so acute in his observation, that we think he would not have passed over the occupation of an old nest in silence. Other writers give a shorter period of incubation: thus the black humming-bird is said to sit twelve days, the young leaving the nest and following their parents in eighteen days; the North American species only ten, the young being ready to fly at the expiration of a week.

The parents are most valiant in defence of their nests. Oviedo relates how they will fly even at the face of a man who climbs a tree where their nests are, and strike him in the eyes, coming, going, and returning so swiftly, that no man would well believe it who had not seen it. Mr. Bullock says that the female of the *Mexican Star*, above noticed, lays two eggs, perfectly white, and large for the size of the bird; and the Indians informed him that they were hatched in three weeks by the male and female sitting alternately. He states that when attending their young, they attack any bird indiscriminately that approaches the nest. 'Their motions when under the influence of anger or fear are very violent, and their flight rapid as an arrow; the eye cannot follow them, but the shrill piercing shriek which they utter on the wing may be heard when the bird is invisible, and often led to their destruction by preparing me for their approach. They attack the eyes of the larger birds, and their sharp needle-like bill is a truly formidable weapon in this kind of warfare. Nothing can exceed their fierceness when one of their own species invades their territory during the breeding season. Under the influence of jealousy they become perfect furies; their throats swell, their crests, tail, and wings expand; they fight in the air (uttering a shrill noise) till one falls exhausted on the ground. I witnessed a combat of this kind near Otumba, during a heavy fall of rain, every separate drop of which I supposed sufficient to have beaten the puny warriors to the earth.' (*Six Months in Mexico.*) Wilson saw them attack and harass the King Bird (*Muscicapa tyrannus*, Briss.).

This pugnacious audacity probably fostered the Mexican belief that these diminutive bodies contained the souls of slain warriors.

Mr. Bullock states that the humming-birds in sleeping frequently suspend themselves by the feet with their heads downwards, in the manner of some parrots.

It may be expected that we should notice a very captivating story. M. Lesson tells us that this charming race has, doubtless, like all existing creatures, numerous enemies; but he declares that the most cruel, the most deadly of all, is that great and monstrous hairy spider, very common throughout the warm parts of America, called by naturalists the *Bird-catching Spider* (*Aranea avicularia*, Linn.). Spreading its nets round about the nests of the humming-birds, it craftily watches the epoch when the young ones come to light, drives away the parents from the nest, sucks and devours their progeny, and sometimes, when it surprises the parents themselves, consigns them to the same fate. Such, adds M. Lesson, is the picture which Bucholz represents in the 5th plate of his first decad.

M. Lesson thus commences the very next sentence: 'Les fables les plus absurdes ont été propagées sur les oiseaux mouches;' and we think that he might, without much fear of contradiction, have added this terrible spider tragedy to the catalogue. The monster in question is a ground insect, and we never heard of its making a web, in the ordinary acceptation of the term. It is certainly big enough to cope with some of the humming-birds, and it is possible that it may creep up trees and surprise the young in the nests; but even this seems to be mere conjecture. The story has been rendered current by the pencil of Madame Merian, which, on this occasion, appears to have been guided by her imagination.

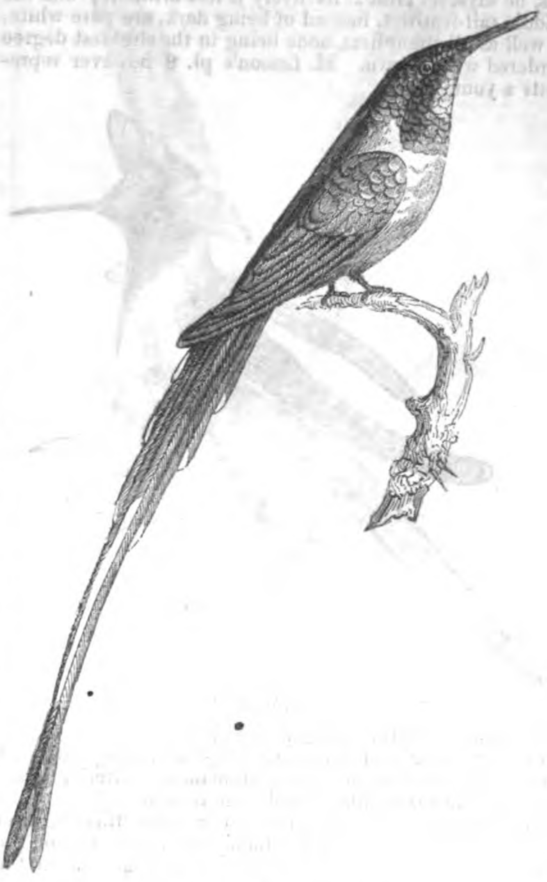
And here we may notice the supposed medical virtues of these bright beings. Powdered humming-bird was considered a specific in cases of epilepsy; and the alleged efficacy of the birds in curing rheumatism secured a place for them in the old European Pharmacopœia.

We proceed to give a very few examples of the multitudinous forms presented by this gorgeous race.

The *Cora Humming-Bird*, *Ornismya Cora*, Less.—Upper part of the head, back, rump, and coverts of the wings, uniform and metallic green. A wide iridescent gorget occupies the throat down to the half of the neck and to the cheeks; the lower part of the neck in front, the breast, and all the lower parts of the body, are tarnished white, with a little brown on the flanks. Tail, consisting of eight brownish feathers, bordered with white within; two middle feathers much longer than the others, white on their internal side, brownish on their external border, and entirely brown at the extremity. Bill slender, black. Feet reddish. Total length five inches five lines (French): of this the tail measures three inches two lines, and the bill six lines.

Locality.—Peru, and especially the Plain of Lima.

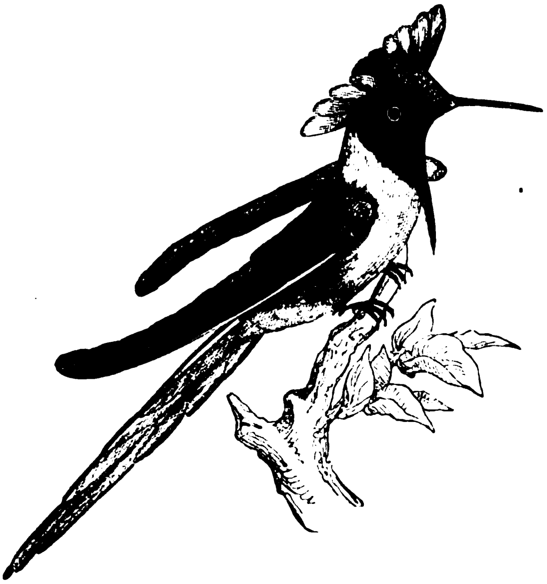
Such is M. Lesson's description in the 'Oiseaux Mouches;' but in the 'Trochilidées' he gives a figure (pl. xxxix.) of the bird in its completely adult state, with its tail in its entire development. The bill, he says, is short, slender, and straight, and completely black, as well as the tarsi. The wings are delicate, recurved, and purpled-brown. The plumage is fresh golden-green above. The throat and the front of the neck sparkle with the violet tint of the amethyst, a white gorget marks the limits of the scaly feathers; and golden-green is spread over the flanks and the belly. The tail-feathers are the longer the more internal they are, and all are stiff, narrow, and of a sword-blade shape. The two external ones are the shortest, the six others are graduated between them, but the two internal ones considerably exceed the preceding, and form two narrow delicate ribands, coloured white for a great part of their length, and only terminated by black at their extremity. The lateral tail-feathers are brown, and finely variegated with white on their borders.


The Cora Humming-Bird. (Lesson.)

At pl. 40 of the same part of his work M. Lesson figures a young bird. The description is given at p. 111, of the text.

The *Double-crested Humming-Bird*, *Trochilus cornutus*, Wied; *Trochilus bilophus*, Temm.; *Ornismya chrysolopha*, Less. *Male.*—Bill and feet very weak and obscure in colour. Two flattened fan-shaped crests, each composed of six small feathers, part from the forehead on a level with the eyes. The brilliancy of these crests surpasses description, glistening as they do with the hues of polished gold and red copper, changing into the gemmy tints of the ruby and emerald, now fire-coloured, anon the purest green, and presently the brightest yellow. The scaly feathers of the forehead between the two crests sparkle with metallic uniform green, changing to steel or sapphire blue. A *camail* of dark changeable violet extends from the throat behind the eyes, and descends along the sides of the neck to terminate in a point of long feathers before the breast. This uncertain violet graduating into a non-metallic blue, with its velvety very dark tint, is sharply defined on the milk-white of the breast, which extends to the lower part of the neck, so as to form a rather large white collar. The lower part of the belly is white; but the middle of the abdomen and the flanks are, like the back, golden-green, with which is mingled a little of the greyish colour of the base of the feathers. Back and sides of the head behind, back, and feathers of the rump, metallic golden-green.

Quills brown. Tail graduated, composed of four feathers longer than the six others: the two middle ones are brown, the two external pure white. The other shorter external tail-feathers are white, but their outer border is variegated with brown. The tail below is white, slightly smoked as it were. The wings reach only to the half of the tail, the general form of which is long, acuminated, and narrow. Length four inches five or six lines. Bill six lines and a half. M. Lesson refers to his pl. 8 for the female, which has, he says, no crest: its livery is less brilliant; and the middle tail-feathers, instead of being dark, are pure white, as well as all the others, none being in the slightest degree bordered with brown. M. Lesson's pl. 8 however represents a young male.

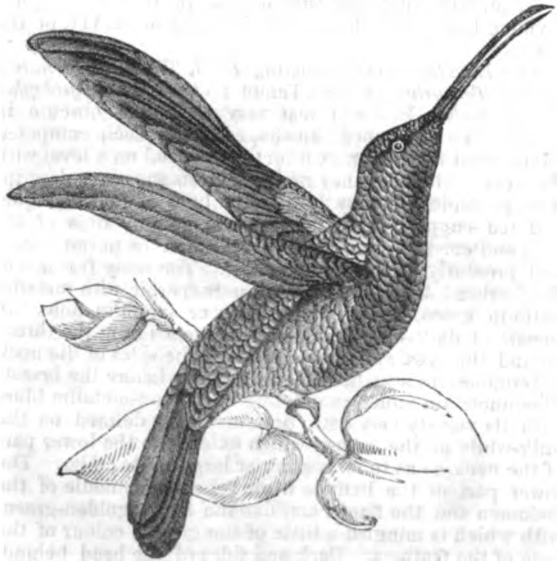


Trochilus cornutus, Wied. Adult Male.

Sickle-winged Humming-Bird, Trochilus falcatus, Sw.

Green; throat and breast shining-blue; body and vent blue-green; tail even, rufous cinnamon; exterior quills falcated, the shafts dilated and compressed.

Mr. Swainson, whose specific character this is, after speaking of the dazzling brilliancy of the colours of the bird, says that it is however more remarkable from the extraordinary construction of its wings, the outer quills of which are greatly curved, and the shafts dilated to a most disproportionate size: a similar structure occurs also, he observes, in the *Broad-shafted Humming-Bird* of Shaw (*Trochilus latipennis*); and he adds that it may not be improbable that such additional strength in the wings has been given as a defence against the small birds of prey (*Lanii*, Linn.) which abound in tropical countries. The cinnamon-coloured tail-feathers are tipped with a purple-black bar; the middle feathers are the darkest, and glossed with green. (*Zool. Ill.*)



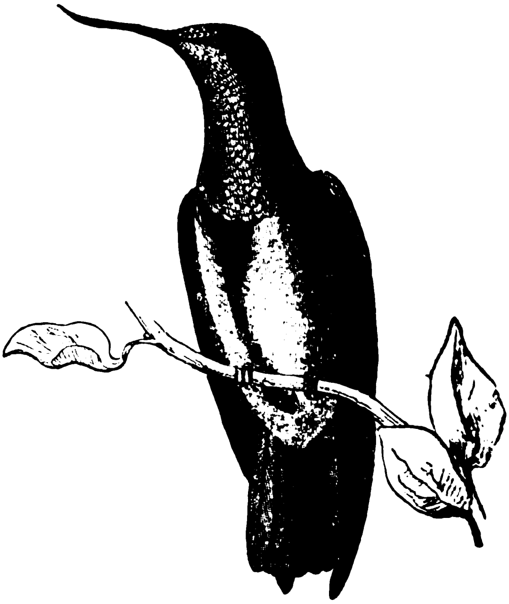
Trochilus falcatus (Swainson), a little reduced.

Locality.—Spanish Main: at least a specimen was sent from thence.

Recurved-bill Humming-Bird, Trochilus recurvirostris, Sw.

Golden-green; throat shining emerald-green; middle of the breast and body black; lateral tail-feathers beneath topazine; bill recurved. (Sw.)

Mr. Swainson remarks that the extraordinary formation in the bill is without parallel in any land-bird yet discovered, and presents in miniature a striking resemblance to that of the Avoset. It is almost impossible, he adds, to conjecture rightly the use of this singular formation; but it appears to him not very improbable that the principal sustenance of the bird may be drawn from the pendent *Bignoniæ* and other similar plants, so common in South America, whose corollæ are long, and generally bent in their tube; the nectar, being at the bottom, could not be reached either by a straight or incurved bill, though very easily by one corresponding to the shape of the flower. (*Zool. Ill.*)



Trochilus recurvirostris. (Swainson.)

Locality.—Peru: at least Mr. Bullock received it from thence.

M. Lesson seems to doubt that the recurvature of the bill is natural; and says that it is very probable that the organ has been compressed and recurved in its fresh state by some art. This doubt is groundless. Indeed M. Lesson himself afterwards records a second species—*Ornismya avocetta.*

Gould's Humming-Bird, Ornismya Gouldii, Less.—M. Lesson states that he owes his knowledge of this charming little bird, which is not known in France to Mr. Charles Stokes, who sent to him a drawing made from an individual in the collection of Mr. George Loddiges.

Of the same size and absolutely of the same form as the little *Huppe Col* (*Ornismya ornata*, Less.), this species, says M. Lesson, of which three or four individuals are known in the London cabinets, is distinguished from that only by its fan-shaped ornaments, which are snow-white and ocellated at their extremity. The pointed and erect tuft on the top of the head is deep chestnut or ferruginous. The back is golden green. A white stripe traverses the rump. The tail is moderate and rounded; the two middle tail-feathers are golden green, the lateral feathers blackish. The wings, which are delicate and narrow, are purpled brown. The front of the neck from the chin to the lower part of the thorax is scaly, and of a very varying lustrous emerald green. The belly, the sides, and the lower belly brownish-green. The feathers which compose the jugular ornaments are disposed in a fan-shape, and so that the longest are outside, and the shortest the most internal. These feathers are all pure white, but the summit of each of them is terminated by an ocellation sparkling with gold and emerald hues encircled by deep green. Bill and feet brownish.

This bird, *Ornismya ornata*, and the *Hausse Col Blanc*, *Ornismya strumaria*, Less., form a small natural tribe. The *Huppe Col*, *Ornismya ornata*, which is figured by M. Lesson (pl. xli., male and female, *Oiseaux Mouches*, very young, pl. xxiv., *Trochilidées*), is found in Guiana, Brazil, and Trinidad; the *Hausse Col*, figured by M. Lesson (pl. xlii., male; pl. xliii., female and young, *Oiseaux Mouches*), is found in Brazil.

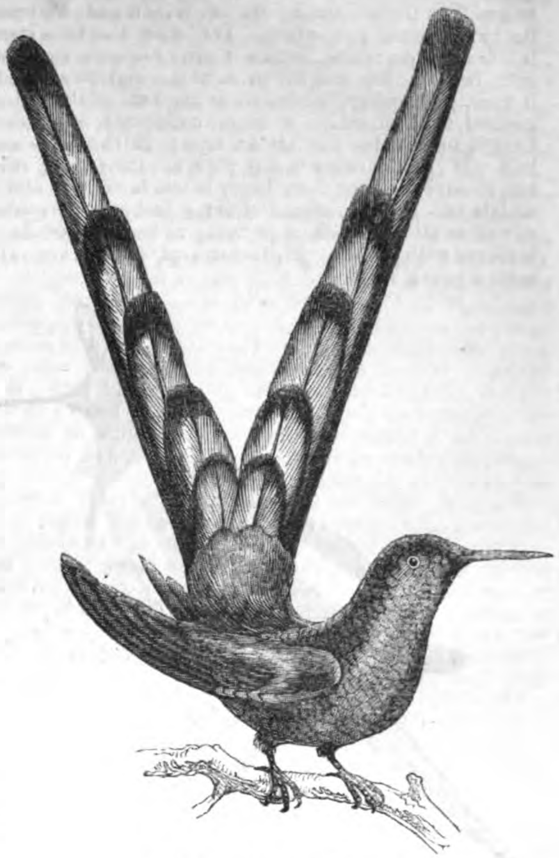
Gould's Humming-Bird. (Lesson; from the drawing above noticed.)

The *Bar-tailed Humming-Bird*, *Sappho Humming-Bird* of Lesson. This is the *Trochilus sparganurus*, or Bar-tailed Humming-Bird of Shaw; *Ornismya Sappho*, Less.; *Trochilus radiosus*, Temm. (Galleries of the Museum); *Trochilus chrysurus*, Cuv.; *Trochilus chrysochloris*, Vieill.

Description.—Male.—Robust, and one of the largest of the family; the tail enormously developed, not less than four inches long, and very deeply forked. Bill nearly straight, pointed, not very long, being not more than seven lines, and black, as are the tarsi. Wings rounded, recurved, and not exceeding the origin of the tail more than an inch. Body about two inches and a half. Throat, breast, and front of the neck covered by a gorget of scaly feathers, from which glance forth the purest emerald green tints, presenting under the lower mandible an aspect of deep velvety green. A small band of more yellow golden green extends from the eye and descends on the sides of the neck. The anal region is furnished with greyish feathers. The whole of the plumage above, as well as the lesser coverts of the wings, is metallic golden green. But the feathers of the rump and the upper coverts of the tail are of a lively shining cinnabar. The quills are purpled-brown, and their shafts bent and widened. The ten tail-feathers are very much graduated. The two middle ones are very short and oval; the two external ones are very long, riband-like, flattened, and exceed the two next by eighteen lines. All of them, squared or slightly rounded at their extremity, glitter variously under the rays of light which fall on them. Their most ordinary hue is that of red copper changing into gold; but occasionally these rich metallic tints change into a sombre purple or violet. Their extremities are terminated by a quadrilateral velvet spot, largest on the longer feathers, but which diminishes upon the shorter ones till on the two middle ones it forms a simple border. M. Lesson gives two figures of this bird; in the second the plumage is more complete. No colours can give an idea of the refulgence of this species when in full feather; even in the richest collection it strikes the eye at once. M. Lesson also gives a figure of the female, in which the tail is much shorter, and the whole colouring tame in comparison with that of the adult male. He admits however that no information accompanied the skin which could prove the sex, and that it may be a young male.

Locality.—The east of Peru.

May we venture, in conclusion, to hint at the possibility of importing these lovely birds, and keeping them in an easy captivity? Father Montdidier, according to Labat, kept humming-birds alive for five or six months, and they brought up their young in his apartment. Don Pedro de Melo, governor of Paraguay, had a humming-bird, taken in the adult state, for many months, as Azara relates, and it became so tame as to caress its master and fly round him for food. Its life was preserved by giving it fresh flowers from time to time, but ordinarily by syrup in a glass, which was held out of the perpendicular to assist the bird in taking the syrup; and it died at last through the negligence of a servant. They have also been sustained for four months by honey and syrup made of bruised sugar and water, placed at the bottom of the corollæ of bell-shaped artificial flowers.



Trochilus sparganurus. (Lesson.)

Mr. Bullock, when in Mexico, had nearly seventy in cages, which, with attention and care, he kept alive for some weeks; and he declares that could he have devoted his whole attention to them, he had no doubt of the possibility of bringing them alive to Europe. The accounts of their being so fierce and untameable as to beat themselves to death when confined, are, he says, not true: no bird is more easily reconciled to its new situation. They are, it is true, he observes, seldom off the wing, but never beat themselves against a cage, nor the glass of a window In each cage was placed a small earthen cup, about half filled with sugar and water of the consistence of a thin syrup; in this various flowers had been inserted, principally the yellow bell-shaped corolla of the great aloe (*Agave Americana*), the end of which, next the stem, being cut off, permitted the liquid to flow into the flower, into which the little prisoners were constantly inserting their long bifid tongues, and drawing up its luscious contents. This operation, he adds, was generally, like most of the actions of the bird, performed on the wing, but they sometimes alighted on the flower, perching against its sides in an upright position.

Captain Lyon, when in Mexico, kept a humming-bird for nearly a month on sugar and water slightly impregnated with saffron. It eagerly sucked this mixture from a small quill, and the Captain adds, that he is sure that with constant attention these little creatures might be kept for a long time. (*Journal* above quoted.)

But the humming-bird has actually been brought alive to England. It is related that a young gentleman, a few days before he sailed from Jamaica, found a female

Mango Humming-Bird sitting on her nest and eggs: he cut off the twig and brought the whole on board. The bird became so tame as to suffer herself to be fed on honey and water during the passage, and hatched two young ones. The mother did not long survive, but the young were brought to England, and continued some time in the possession of Lady Hammond, from whose lips they took honey; and though one did not live long, the other survived for at least two months from the time of their arrival.

Now this happened before the introduction of steam-navigation by sea; and as we read of fresh bouquets of American flowers crossing the Atlantic, a little care and management in May and June might bring living humming-birds in a fortnight or three weeks to our shores, where our stoves and greenhouses with a little precaution might offer them an asylum. They are disposed to become familiar. Wilson mentions one which would enter the window, examine the flowers in the room, and pass out at the opposite door; and this same bird was known to take refuge in a hothouse when the cool nights of autumn came, going forth regularly in the morning, and returning as regularly in the evening for several days.

We have heard an instance of still greater boldness, where the bird suffered the window, the only outlet, to be shut after it had entered for the purpose of examining the flowers in the room. Honeyed liquor being placed in a bell-shaped flower and held in a person's hand, the humming-bird, nothing daunted, came and fed from the flower when so held.

These facts lead us not to despair of seeing living humming-birds in England.

TRO'CHILUS. [TROCHILIDÆ.]

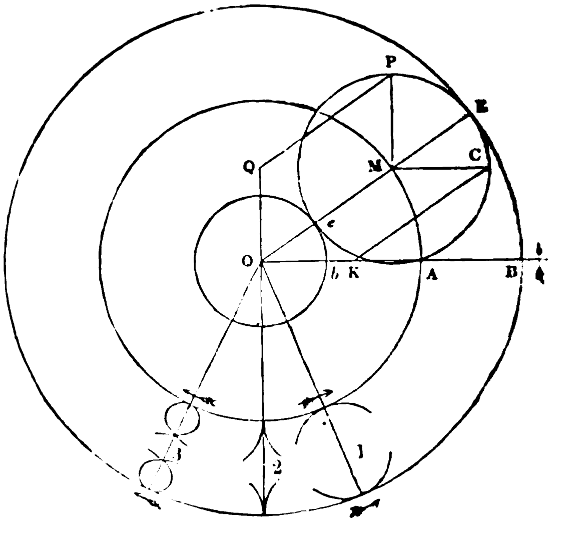
TROCHOIDAL CURVES. Under this term is included a large number of lines which are produced by the composition of two circular motions, including the straight line, the circle, the ellipse, a class of curves called epitrochoids, of which one particular case is called the epicycloid, and a class called hypotrochoids, of which one particular case is the hypocloid. Among these must also be included the extreme case in which one of the motions is rectilinear, which gives the common trochoid, the cycloid, and a class of spirals which includes the involute of the circle, the spiral of Archimedes, and others.

There are two ways of considering these curves. The first, which is universally adopted, may properly be called the *trochoidal* mode (τροχος, a hoop), because in it one circle is made to roll like a hoop, either upon a straight line, or upon the circumference of another circle. The second, which we believe might be advantageously substituted for the first, we shall propose to call the *planetary* mode, because it resembles the consideration of the manner in which a planet and its satellite move round the sun. Here a circle, without any rolling, has its centre carried round the circumference of another. As there is no elementary work which treats of these combined motions, though some understanding of them is necessary even for the purposes of the most elementary astronomy, we shall first enter into this subject at more length than usual, endeavouring to make ourselves understood by those who have the first notions of geometry and of the composition of motion: we shall then, more briefly, consider the application of the differential calculus.

Let the point M (*fig.* 1) be carried uniformly round the circumference of the circle A M, and let M be the centre of a circle whose radius is M C (= A B). Let a point P be carried about the moving circle, so that its angular velocity from a line of fixed direction in the moving circle (say M C parallel to A B) always bears a given proportion to the angular velocity of M, say that of $n : 1$. That is, when the line O M has described the angle M O A, the line M P has described the angle P M C, which is n times M O A. It has been supposed that when M was at A, P was at B. The point P will describe a curve which is one of those called *trochoidal*; or, on this explanation, *planetary*. And the circle C P being always contained between two fixed circles, B E and $b\,e$, the planetary curve is always contained between those two circles. We shall now propose a nomenclature for the principal parts of this system.

As in the Ptolemaic mode of considering the planets, let the fixed circle A M be called the *deferent*, the moving circle C P the *epicycle*. Let M be the *mean point*, P the *planet*, O the *centre*, and let the planet be said to be in its *apocentre* or *pericentre*, when it is farthest from, or nearest to, the centre. And as every apocentre must lie on B E, and every pericentre on $b\,e$, let these circles be called respectively apocentral and pericentral. Let O P, as usual, be called the radius of the curve, or its *radius vector*; and the angle P O A its *vectorial angle*. When the revolution is in the direction from A to M, let it be called *direct*: when in the contrary direction, *retrograde*. Let angle M O A be called the *mean* or *deferential angle*, and denoted by ϕ; and let the P M C be called the *epicyclic* angle, being denoted of course by $n\phi$. Let the angle contained between the pericentral and apocentral radii be called the *angle of descent*. The following theorems will be readily seen, as soon as these terms are understood:—

Fig. 1.



1. The planetary curve beginning from its apocentre at B, and the epicyclic motion being direct, and greater than the mean motion, there will be a pericentre as soon as P M C has gained two right angles upon E M C or M O A, that is when $n\phi - \phi = 180°$, or ϕ is 180° divided by $n-1$.

2. But if the epicyclic angular motion, being still direct, be less than the mean motion, so that E M C is greater than P M C, there will be a pericentre when E M C has gained two right angles upon P M C, or when $\phi - n\phi = 180°$, or ϕ is 180° divided by $(1-n)$.

3. And if the epicyclic motion be retrograde, so that P begins to move the other way from C, there will be a pericentre when E M C and P M C together make two right angles, or when $\phi + n\phi = 180°$, or when ϕ is 180° divided by $1 + n$.

4. When the planet has come to its pericentre, it will begin immediately to ascend towards the next apocentre, in a curve of the same form as that by which it descended, but inverted in position, the parts preceding and following the pericentre being alike, and the part preceding the next apocentre resembling that following the last apocentre. As soon as the second apocentre is gained, the curve will start again, in the same manner as the first. If n be a commensurable number, say $p \div q$, where p and q are integers, and the fraction is in its lowest terms, the curve will return into itself when M has completed q revolutions: there will be, if the epicycle be direct, $p-q$ or $q-p$ apocentres, and as many pericentres; but if the epicycle be retrograde, there will be $p+q$ apocentres, and as many pericentres. But if n be incommensurable, the convolutions will go on for ever, and the curve will never be completed. We have therefore, in order to obtain the form of the curve, only to consider one descent from apocentre to pericentre or one ascent from pericentre to apocentre: though the general appearance of the curve depends much on the effect of many convolutions.

5. Every planetary curve may be described by two distinct epicyclic motions. For if we describe the parallelogram O M P Q, we see that the point Q describes a fixed circle equal to the epicycle, while Q P is the radius of a moving circle equal to the deferent. If then the radius

the deferent be a, that of the epicycle b, and the epicyclic angular velocity be n times the deferential or mean velocity, it gives the same planetary curve as if the radius of the deferent were b, that of the epicycle a, and the epicyclic velocity $1:n$th of the deferential. If then we take the epicycle to be the least of the two, we do not limit our investigation, provided we consider every possible case of epicyclic velocity.

The actual motion of the planet, compounded of both motions, deferential and epicyclic, may be either direct or retrograde: and the curves may be best classified by observing whether the motions at the pericentres and apocentres are direct, retrograde, or neither. At 1 is represented a case of each motion, pericentral and apocentral, direct; at 2, a case of each motion, when it is neither direct nor retrograde, that is, directly towards the centre; at 3, a case of each motion, retrograde. We shall now consider how to make the separation of these cases.

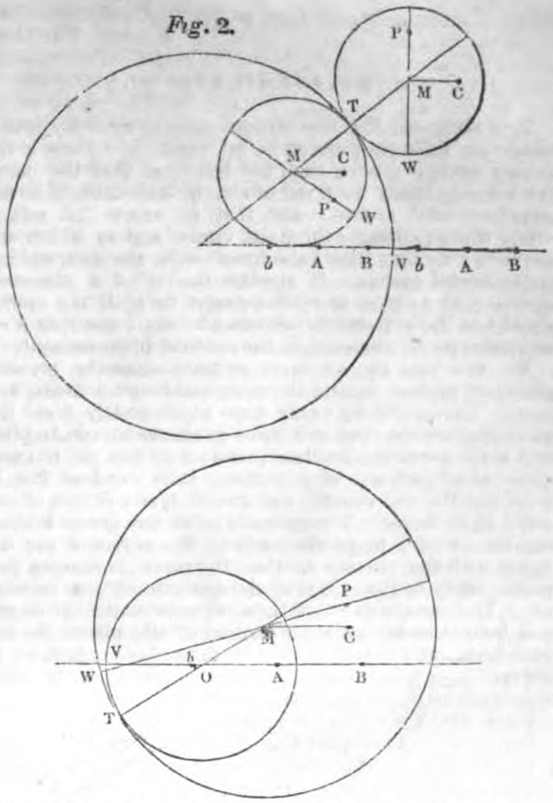
First, as the apocentres. When the motion in the epicycle is direct (for abbreviation, say when the epicycle is direct), the two motions conspire; the line M C, then at A B, is being carried forward with the velocity of A, while P is being carried from M C. Let angles be measured in theoretical units [ANGLE], and let the deferential or mean velocity be 1, then the linear velocity of A is a, and that of P, when at B, is the linear velocity to an angular velocity n and radius b, or nb. Consequently $a+nb$ is the apocentral velocity, which is direct; or the apocentral velocity is always direct when the epicycle is direct. But if the epicycle be retrograde, the line M C is advancing with the velocity a, while P is receding from it with the velocity nb. Consequently, when the epicycle is retrograde, the apocentral velocity is direct, neither, or retrograde, according as a is greater than, equal to, or less than, bn.

Next, as to the pericentres. We can make a pericentre by supposing the planet to be at b when M C is on A B. Now if the epicycle be direct [MOTION, DIRECTION OF], the line B b being carried forward with the velocity a, the planet is carried backwards with the velocity nb. Consequently, when the epicycle is direct, the pericentral motion is direct, neither, or retrograde, according as a is greater than, equal to, or less than, nb. But when the epicycle is retrograde, the motion of the planet at b, as well as that of b B, is in advance, and $a+nb$ represents the whole velocity: consequently, when the epicycle is retrograde, the pericentral motion is always direct. Observe that we name the deferential motion with respect to the centre, and the epicyclic motion with respect to the centre of the epicycle: as explained in the article cited, a motion may be direct with respect to one, and retrograde with respect to the other.

We shall now consider the trochoidal mode of viewing the subject, previously to combining the two. Let the circumference of one circle roll upon that of another, any point on, inside, or outside of the rolling circle (if outside, of course supposed to be fixed to it by a carrying arm) describes a curve by the motion compounded of the motion of the rolling circle round its own centre, and the motion of that centre round the centre of the fixed circle. Three cases may be supposed, as in the following diagrams (*fig.* 2). The two convexities may be opposed, or the rolling circle may roll outside the other; or the concavity of one may fit the convexity of the other. This last divides into two cases: first, when the rolling circle is the smaller, in which case it rolls entirely inside the other; next, when the rolling circle is the larger, in which case the fixed circle is always inside the other. Now each of these cases may easily be reduced to a much more intelligible planetary system, by which much of their difficulty will be removed. It should be observed that when the convexities are opposed, the trochoidal system is called *epi*-trochoidal, and when concavity fits convexity, *hypo*-trochoidal. We call the radius of the fixed circle F, and of the rolling circle R.

1. Every epitrochoidal system is a planetary system in which the epicycle is direct. Taking the circle which rolls entirely outside the other, P is the point describing the curve, and T W has rolled over T V since P was at B. Now O M is constant, being F+R, so that, since P rolls uniformly round M, here is a planetary system in which O M is the radius of the deferent, M P that of the epicycle (which is direct) and the epicyclic velocity is to the deferential as the angle P M C to M O A. Now the arcs T W and T V are equal, whence T O A being ϕ, and T M W being ψ, we have $F\phi = R\psi$, or

Fig. 2.



$$PMC = \left(\frac{F}{R}+1\right)\phi;\ \text{so that } \frac{F+R}{R} \text{ is the ratio of the velocities.}$$

Hence, looking at the double generation of every planetary system, we have either

$$a = F+R,\ b = MP,\ n = \frac{F+R}{R};$$

$$\text{or } a = MP,\ b = F+R,\ n = \frac{R}{F+R}.$$

2. Every hypotrochoidal system in which the rolling circle is the larger of the two is a planetary system in which the epicycle is direct. Here, in the proper diagram, W T has rolled over V T, as before, O M and M P are the radii of the deferent and epicycle, and the epicyclic velocity is to the deferential as the angles P M C and M O A; and $OM = R - F$. If M O A and T M W be ϕ and ψ, we have, from the equal arcs T W and T V, $R\psi = F\phi$, and

$$\angle PMC = \phi - \psi = \left(1 - \frac{F}{R}\right)\phi;\ \text{whence } \frac{R-F}{R} \text{ is the ratio of the velocities.}$$

We have then either

$$a = R-F,\ b = MP,\ n = \frac{R-F}{R};$$

$$\text{or } a = MP,\ b = R-F,\ n = \frac{R}{R-F}.$$

3. Every hypotrochoidal system in which the rolling circle is the smaller is a planetary system in which the epicycle is retrograde. In the proper figure it is now evident enough that O M, the radius of the deferent, is F−R; and that, M O A and W M T being ϕ and ψ, we have $R\psi = F\phi$, from the equal arcs T V and T W. It is plain also that M P, the radius of the epicycle, moves with a retrograde velocity. Moreover, the epicyclic and deferential velocities are as the angles P M C and M O A, and ($R\psi$ being $= F\phi$)

$$\angle PMC = \psi - \phi = \left(\frac{F}{R} - 1\right)\phi,\ \text{and } \frac{F-R}{R} \text{ for the ratio of the velocities.}$$

Either then

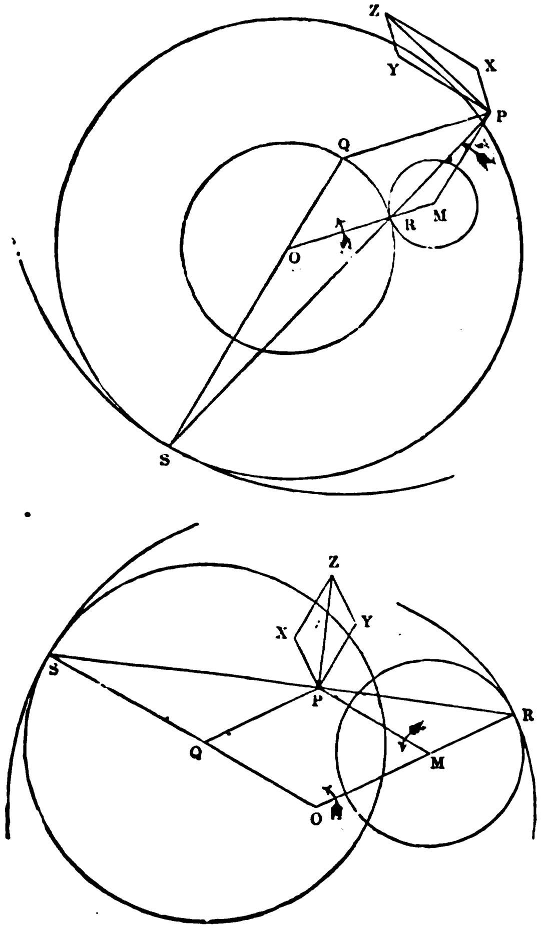
$$a = \mathrm{F} - \mathrm{R},\ b = \mathrm{MP},\ n = \frac{\mathrm{F} - \mathrm{R}}{\mathrm{R}};$$

$$\text{or } a = \mathrm{MP},\ b = \mathrm{F} - \mathrm{R},\ n = \frac{\mathrm{R}}{\mathrm{F} - \mathrm{R}}.$$

To distinguish the two hypotrochoidal systems, which have very different properties, let that one in which the rolling circle is smaller than the fixed, so that the curve lies entirely inside the fixed circle, be called the *internal* hypotrochoidal system; and that in which the rolling circle always contains the fixed circle, and in which the curve is entirely without the fixed circle, the *external* hypotrochoidal system. It appears then that a planetary system with a direct epicycle belongs to both the epitrochoid and the external hypotrochoid: while one with a retrograde epicycle belongs to the internal hypotrochoid.

We now take the converse problem—namely, given a planetary system, to find the corresponding trochoidal systems. This might be easily done algebraically from the preceding results, but a simple geometrical construction will much assist the beginner, who rarely can get the true phase of a figure out of formulæ. It is required first to construct the real velocity and direction of a planet at any point of its curve. The epicycle is, at any given instant, moving forward perpendicularly to the radius of the deferent with the velocity a, while the planet is moving perpendicularly to the radius of the epicycle with a velocity nb. The composition of these two velocities gives the real motion and direction of motion of the planet for the time being, and shows us how to draw the tangent of its curve.

Fig. 3.



Let O M and M P (*Fig.* 3) be radii of the deferent and epicycle (not drawn); and from P, the planet, draw P X and P Y perpendicular to O M and M P. Make P X to P Y as a to nb, and complete the parallelogram P X Y Z. Then P X represents the motion, for the instant, of the whole epicycle, and P Y the motion of the planet in the epicycle whence P Z represents the planet's actual velocity, and P Z is tangent to its curve. In the first of the figures the epicyclic motion is direct, and in the second retrograde, the arrows showing the direct motion of revolution. Also, for variety, the planet is placed much nearer to its pericentre in the second figure than in the first.

Draw P S R perpendicular to P Z, meeting O Q and O M in S and R. Then, the sides of the triangles Q P S, P M R, being severally perpendicular to those of P Z X, these three triangles are similar to one another. Hence

$$\mathrm{PQ}\,(=a) : \mathrm{QS} :: \mathrm{PX} : \mathrm{XZ} :: a : nb, \text{ or } \mathrm{QS} = nb$$

$$\mathrm{PM}\,(=b) : \mathrm{MR} :: \mathrm{ZX} : \mathrm{XP} :: nb : a, \text{ or } \mathrm{MR} = \frac{a}{n}$$

In the second figure, or when the epicycle is retrograde, it will always be found that R and S are in O M and O Q produced: but the first figure, as drawn, is good only for the case in which n is greater than 1, as was supposed in the construction, and is seen in the result, since Q S or nb) is greater than Q O (or b), and R M (or $a : n$) is less than O M (or a). If n had been less than 1, P S would have passed through O Q; but in all cases of direct epicycle, one of the sides O M and M Q is cut externally and the other internally; while in every case of retrograde epicycle, both are cut externally. We have then

$$\text{Epicycle retrograde}\begin{cases}\mathrm{OS} = b\,(1+n), & \mathrm{QS} = bn\\ \mathrm{OR} = a\left(1+\dfrac{1}{n}\right), & \mathrm{MR} = \dfrac{a}{n}\end{cases}$$

$$\text{Epicycle direct}\begin{cases} n > 1 \begin{cases}\mathrm{OS} = b\,(n-1), & \mathrm{QS} = bn\\ \mathrm{OR} = a\left(1-\dfrac{1}{n}\right), & \mathrm{MR} = \dfrac{a}{n}\end{cases}\\ n < 1 \begin{cases}\mathrm{OS} = b\,(1-n), & \mathrm{QS} = bn\\ \mathrm{OR} = a\left(\dfrac{1}{n}-1\right), & \mathrm{QS} = \dfrac{a}{n}\end{cases}\end{cases}$$

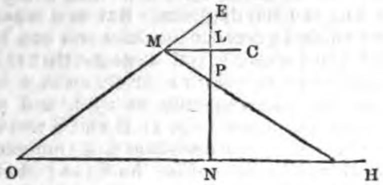
We can now immediately show that every planetary curve can be trochoidally described in two ways, it being already known that every trochoidal curve can be planetarily described in two ways. It appears that O R and O S are the same for every position of the planet in a given system, since they depend only on a, b, and n. Consequently, while the planet moves, R and S revolve in circles about O; and if we now pass to a trochoidal system in which O R is the radius of the fixed, and M R of the revolving circle, the point P, connected with the revolving circle by the arm M P, will describe a trochoidal curve which is identical with the planetary curve, from the elements of which its circles were obtained. Or O S may be made the radius of the fixed circle, and Q S of the revolving circle, the arm of connection being Q P. For instance, if we take the retrograde epicycle, and make

$$\mathrm{F} = b\,(1+n),\ \mathrm{R} = bn;\ \text{then } b = \mathrm{F} - \mathrm{R} \quad n = \frac{\mathrm{R}}{\mathrm{F} - \mathrm{R}},$$

which are the equations, already found, of connection between the internal hypotrochoidal system and its corresponding planetary one: and similarly for the other cases. And the result is, as appears from the figure, that every direct-epicycle planetary system is both epitrochoidal and externally hypotrochoidal, while every retrograde-epicycle planetary system is in two different ways internally trochoidal. We are thus enabled to refer the description of all the trochoidal curves to their corresponding planetary systems, which are much more easily followed, especially when, as is always in our power, we make the radius of the epicycle not exceeding that of the deferent. It has appeared that when $a = bn$, the planet has no motion of revolution, at the apocentre in a retrograde epicycle, and at the pericentre in a direct epicycle; the motion must then at those epochs be all from or to the centre, giving curves with such cusps as are shown in a former diagram. Now, looking at the corresponding trochoidal systems, we see that when $a = nb$, $\mathrm{QS} = \mathrm{QP}$, and $\mathrm{MR} = \mathrm{MP}$, or the point which describes the trochoid is *on the circumference of the rolling circle*. In this case the epitrochoid is called an epicycloid, and the hypotrochoid an hypocycloid. And since in all cases the line which joins P with the point of contact of the circles (R or S) is normal to the curve, or perpendicular to the tangent, it follows that in the epicycloid and hypocycloid, the two chords which join the point that traces out the curve with the two extremities of the central diameter of the rolling circle are, one tangent, and the other normal, to the curve.

We shall now pass on to the consideration of the varieties which planetary curves offer; and first we have to separate some extreme or critical cases from the rest. These are when $n = 1, 0$, or -1, for we shall now begin to distinguish direct from retrograde epicyclic motion by making n negative in the latter case. When $n = 1$, P (*Fig.* 1) will be always in the continuation of OM, either at E or *e*, as it was first placed; consequently the planetary curve is here only the apocentral or pericentral circle of other cases. If $n = 0$, P will always coincide with C: now C describes a circle equal to the deferent, but having its centre at K, OK being equal to the radius of the epicycle. If $n = -1$, the angle CMP (*Fig.* 4) is always equal to MON, and the triangles EON, CMP are similar: whence EP, or twice LP, is always a given proportion of EN, the ordinate of a circle: it follows then that the planetary curve is an ellipse when $n = -1$. But when $a = b$, the point P is always at H, in the line OH, and the planetary curve is as much of the straight line OH as extends from twice OM on one side to twice OM on the other. Looking at the trochoidal character of these varieties, we have, when $n = 1$, either $F = 0$, $R = b$, or $F = 0$, $R = a$: that is, the curve then described is made by a circle revolving round a point in its circumference; in both cases we have a circle. But when $n = 0$ we have $F = b$, $R = 0$, or the trochoidal curve belongs to a point connected with a circle of no radius, which revolves on a circle of the radius b, or OK. This is one of those extreme cases which are rather interpreted than perceived [INTERPRETATION]: if a circle of no radius revolve from K, it can never make any progress, and the arm KC, which carries the moving point, is always describing a circle. It is the extreme case of the following supposition: let a circle of extremely small radius revolve on the circle of radius OK, carrying with it the arm KC: it will make but little progress on the larger circle in many revolutions; during which C will describe many nearly circular folds very close to each other. Lastly, when $n = 1$ retrograde, we have $F = 2b$, $R = b$, or the fixed circle has twice the radius of the rolling circle. When $a = b$, the point which describes the curve is on the circumference of the rolling circle; and thus we have the following theorem. When a circle rolls inside another of double its diameter, every point attached to that circle, internally or externally, describes an ellipse: but every point on the circumference of the rolling circle describes a straight line, the extreme limit of an ellipse.

Fig. 4.



Since we can always suppose the lesser of the two circles to be the epicycle, and the greater the deferent, when there is a lesser and a greater, there is yet another extreme case in which the epicycle and deferent are equal, so that all the pericentres are in the centre O itself, for now the epicycle always passes through that centre. This case will be best considered after the several other cases of which it is the extreme. We now go on to the general question, namely, having an epicycle less than the deferent, and having both radii given, required the forms of all the varieties of the planetary curve which arise from giving different values to n.

We may recapitulate the formulæ first given with their algebraical character, as follows:—The radius of the deferent is a, that of the epicycle b, the ratio of the angular velocity of the planet in the epicycle to that of the epicycle round the deferent is n, which is negative when the epicycle is retrograde. The angle moved through by the centre of the epicycle since the last epoch when the planet was at its apocentre being ϕ, that moved through by the planet round the epicycle in the same time is $n\phi$, and when the planet has come to its pericentre, ϕ is $180° \div (n-1)$, this meaning, when positive, that the radius of the epicycle has gained 180° in direction upon that of the deferent; and, when negative, that the radius of the deferent has gained 180° upon that of the epicycle. And the apocentral velocity of the planet is $a + nb$, n having its proper sign, its absolute revolution round the centre being direct or retrograde, according as $a + nb$ is positive or negative. The pericentral velocity is $a - nb$, to be interpreted in the same manner. In the corresponding trochoidal systems, F and R being the radii of the fixed and rolling circles, and C the length of the arm which carries the moving point, measured from the centre of the rolling circle to which it is attached, we have either

$$F = b\,(1-n), \qquad R = bn,\ C = a, \text{ or}$$

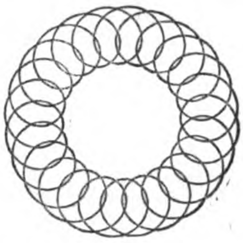
$$F = a\left(1-\frac{1}{n}\right),\ R = \frac{a}{n},\ C = b,$$

where n is to have its proper sign, and

F positive, R positive, denotes an epitrochoidal system.
F negative, R positive, ... external hypotrochoical system.
F positive, R negative . . . . . . internal hypotrochoidal system;

or, in fact, that circle only which sees the concavity of the other, is to have its radius counted as negative. This is an induction from the various previous cases, such as the student of algebra will readily make.

I. *When* n *diminishes from a great value down to* a $\div$ b. Let us first suppose n very great and positive, so that the angle from apocentre to pericentre is small, the apocentral revolution direct, the pericentral retrograde. Passing to the trochoidal systems, both circles are large in the external hypo-system; and the fixed circle nearly equal to the deferent, and the rolling circle small, in the epi-system: also the planet is far within the circumference of the rolling circle in the external hypo-system, and far without it in the epi-system. All this must be collected from the formulæ. The curve is then of the following form:—



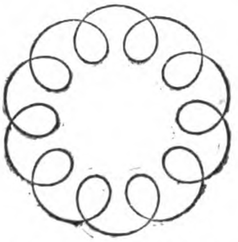
The angle during which the revolution of the planet is absolutely retrograde is always thus found:—Determine ϕ from the equation

$$\cos\,(n-1)\,\phi_1 = -\frac{a^2 + b^2 n}{ab\,(1+n)},$$

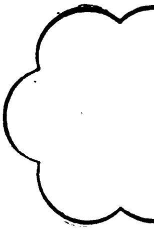
which can always be done if the second side be less than unity. Then the retrogradation begins when $\phi = \phi_1$ and ends when

$$\phi = \frac{360°}{n-1} - \phi_1.$$

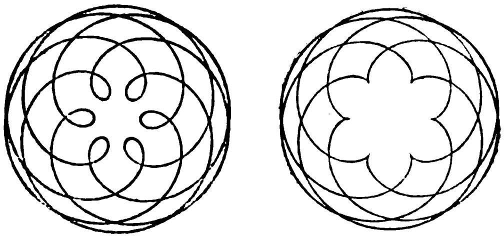
As n diminishes, the angle from apocentre to pericentre increases; the radii of both circles in the external hypotrochoidal system diminish; in the epitrochoidal system the fixed circle grows less, and the revolving one greater, both the circumferences approaching the planet. When n grows small enough, being still so large that $a < nb$, the loops cease to interlace, and become separately visible.



This goes on until n is so far reduced in value that $a = nb$, when the pericentral velocity vanishes, both the trochoidal systems have the planet upon the rolling circle, the loops degenerate into cusps, and we have epicycloids, as follows:—

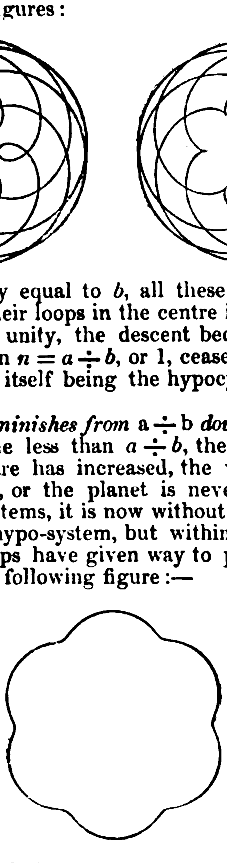


Towards the end of this division the character of the curve may be much affected by the relative value of b and a. At the epicycloid, when $n = a \div b$, the angle from apocentre to pericentre, as subtended at the centre, is $180^\circ \div (n-1)$ or $180\, b \div (a-b)$ in degrees. The nearer $a \div b$ is to unity the greater does this angle become, and if a be near enough to b, it may be increased to any amount: so that a planet might descend from apocentre to pericentre through thousands of thousands of revolutions before it formed its loop or cusp, and began to ascend, as in the following figures:



If a be actually equal to b, all these curves have the lower points of their loops in the centre itself, but as n diminishes down to unity, the descent becomes slower and slower; and when $n = a \div b$, or 1, ceases altogether, the apocentral circle itself being the hypocycloid of this extreme case.

II. *When* n *diminishes from* a $\div$ b *down to* 1. When n has become a little less than $a \div b$, the angle from apocentre to pericentre has increased, the velocities at both places are direct, or the planet is never retrograde. In the trochoidal systems, it is now without the rolling circle of the external hypo-system, but within that of the episystem. The cusps have given way to points of contrary flexure, as in the following figure:—



The way to find these points of contrary flexure is as follows:—Find ϕ_2 from the equation;

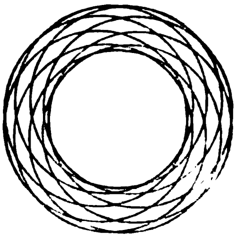
$$\cos (n-1)\, \phi_2 = - \frac{a^2 + b^2 n^3}{abn(n+1)};$$

then there is one point of contrary flexure when $\phi = \phi_2$; and another when

$$\phi = \frac{360^\circ}{n-1} - \phi_2$$

As n diminishes, these points of flexure, after approaching somewhat towards the apocentre, cease that approach, and begin to return towards the pericentre, in which they are lost when n has come down to the square root of $a \div b$. But this time they do not unite in the cusp from which they came, but the convex part of the curve disappears, in such a manner as to give a remarkable straightness to the parts adjoining the pericentres.

When n is less than $\sqrt{(a \div b)}$ the curve is always convex, and the angle from apocentre to pericentre perpetually increasing, the descent may be made as slow as we please, as in the following:—

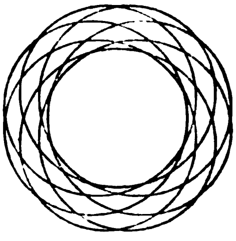


At the limit of this case, when n becomes 1, all descent ceases, and the apocentral or pericentral circle is all that is left, as before described.

At the beginning of this section of curves, the planet was upon the rolling circle in both trochoidal systems: it immediately passes outside the rolling circle in the external hypo-system, and inside the rolling circle in the episystem. Moreover, in the former the fixed circle gets smaller, and the rolling circle approaches the epicycle, so that when $n = 1$, the external hypo-system is merely the epicycle revolving round a point in its circumference. But in the latter, as n approaches to 1, the rolling circle approaches the deferent in size, while the fixed circle becomes smaller and smaller: its extreme case coincides with the extreme case of the former system.

III. *When* n *diminishes from* 1 to 0. The angle from apocentre to pericentre, or the angle of descent, as we may call it, which left off infinite at the end of the last section, immediately becomes very great and negative when n is a little less than 1; indicating that the descent is performed by the radius of the deferent gaining upon that of the epicycle, instead of the contrary. The curve is always concave to the centre, and at first, in its long folds, much resembles that of the last diagram. But as n diminishes towards 0, the angle of descent becomes less and less, and is only -180° when $n = 0$; and during this time, the descent becomes more and more circular, until, when $n = 0$, we have nothing but the circle with centre K and radius K B, as before explained (*fig.* 1). As to the trochoidal systems, the external hypo-system and the epi-system have changed formulæ: in the latter, the fixed radius changes from 0 to b, and the rolling radius from b to 0, the planet being always outside the rolling circle: the extreme case has already been explained. But in the former system both radii increase without limit, and become infinite when $n = 0$, the planet being always within the rolling circle. The extreme case must be thus explained [INFINITE]: to construct a planetary curve in which the epicyclic motion is very slow compared with the deferential, by means of its external hypo-trochoidal system, we must take both radii, fixed and rolling, very large, and the larger the slower the relative epicyclic motion, without limit.

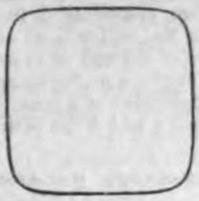
IV. *When* n *increases negatively from* 0 *to* −1. The angle of descent, which left off at -180°, now diminishes in amount, being still negative; and by the time $n = -1$, it brings us, as we have seen, to an ellipse, which is -90°. The apocentral and pericentral velocities are still positive throughout this section, and the curve is a series of shorter concave descents. The final ellipse has $a + b$ and $a - b$ for the semi-axes.



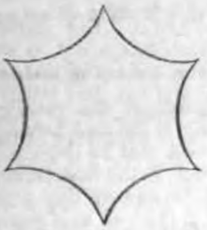
Both the trochoidal systems are internal hypo-systems, the planet being inside the larger of the rolling circles, and outside the smaller. At the extreme case, the ellipse, the two systems are the same, and in both cases the fixed circle becomes double of the rolling circle in diameter. Before the extreme case, the greater rolling circle belongs to the greater fixed circle, and the less to the less.

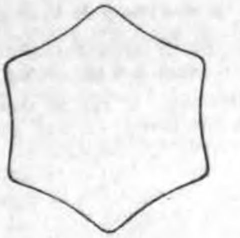
V. *When* n *increases negatively from* −1 *to* $-a \div b$.

Something resembling the last continues (the angle of descent still diminishing) until that angle is too small to allow of a descent wholly concave. By the time n becomes $-\sqrt{(a \div b)}$ the descent is almost a straight line, except very near the apocentre, and when n is greater than $\sqrt{(a \div b)}$, taken negatively, there are points of contrary flexure dividing the convex from the concave part as before.



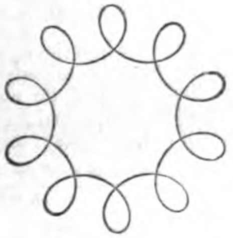
These points of contrary flexure do not, as before, return to the pericentre at which they begin; but as n varies from $-\sqrt{(a \div b)}$ to $-a \div b$, they run up the arc of the curve, and unite at the apocentre, when $n = -b \div a$, in a cusp. This cuspidated curve is the hypocycloid, and up to this point both apocentral and pericentral motions are direct.



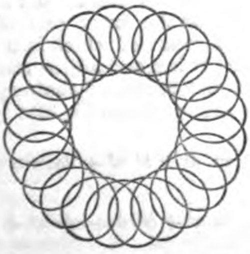


The only change that has taken place during this time in the trochoidal systems is a continual increase of both circles in one of them, and a continual diminution of both in the other. At the hypocycloid both the rolling circles are thus brought to pass through the planet, and the fixed circles become equal. The common radius of the fixed circles is $a + b$, those of the rolling circles are a and b.

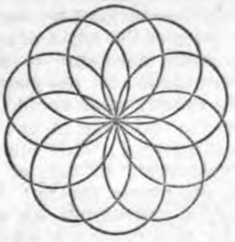
VI. *When* n *increases negatively from* $- a : b$. We left off with the hypocycloid at which the apocentral motion (in revolution) is nothing. This apocentral motion afterwards becomes retrograde, the pericentral continuing direct, so that apocentral loops begin to be formed; and the central angle of retrogradation, in which the planet passes through the higher part of a loop, may be found from a preceding formula.

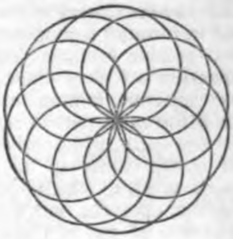


As n increases, these loops become nearer and nearer, and at last begin to interlace, the angle of descent continually diminishing. In the trochoidal systems, both circles of one of the hypo-systems increase without limit with n, while in the other the fixed circle perpetually becomes more nearly equal to the deferent, while the rolling circle diminishes without limit. As n increases, each of the loops more and more nearly coincides with the epicycle, and the extreme limit is a circle of *no radius*, carrying the planet on an arm equal to the radius of the epicycle, and revolving on a circle equal to the deferent: or a revolution in an epicycle whose centre is fixed. This limit of course is never attained; or perhaps the analyst would say, that when n is infinite, the planet goes over the whole space between the apocentral and pericentral circles.



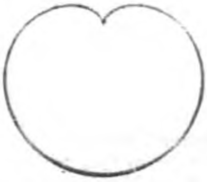
When the deferent and epicycle are equal, or $a = b$, the epicycloid becomes the apocentral circle, and the hypocycloid the straight line. The other curves take various extreme forms, as in the following diagrams:—





There is never any sensible arc of retrogradation; all the retrogradation, as it were, taking place suddenly at the pericentre, that is, at the centre. We shall leave the further investigation of these cases to the student.

When $n = 2$, the angle of descent is always 180°, and the epicycloid has the rolling and fixed trochoidal circles equal, and is a curve shaped somewhat like a heart, whence it is called the *cardioide*.



On these curves generally we may remark, that their minor modifications of form are very various. The descent through a point of contrary flexure, for example, gives two curves of very different figures, according as the angle of descent is more or less than a right angle; and the loops may be made very small or very large, compared with the rest of the curve. It must be particularly noticed also, that by the angle of descent we mean simply the angle between the apocentral and pericentral distances, not the vectorial angle described in going from one to the other: the latter may become greater than this angle of descent before the pericentre is arrived at, and then diminish down to the angle of descent.

Let us now suppose the deferent to become a straight line, or $a = \infty$, and let the centre of the epicycle be carried along this line with a velocity a, while the planet moves in the epicycle with an angular velocity ν in theoretical units. Curves will now be described which are called *trochoids*, among which the CYCLOID has the same place as the epicycloid among the epitrochoids, or the hypocycloid among the hypotrochoids. The forms can be readily imagined by conceiving the deferent to be a circle of great radius. It is now of no consequence whether the epicyclic motion be direct or retrograde. If ν be very great, we have a series of interlacing loops; when ν becomes less, these loops separate; when $a = \nu b$, the loops degenerate into cusps, and we have the cycloid; and when a is greater than νb we have only a series of undulations with points of contrary flexure. All this may be represented by a trochoidal system in which a circle rolls upon a straight line, carrying with it an arm to which the planet is attached; and the trochoid is looped, cycloidal, or wavy, according as the planet is without, on, or within, the rolling circle. It will be a good exercise for the student to deduce the centre and radius of the rolling circle from a construction similar to that hereinbefore employed for deducing the elements of the trochoidal from those of the planetary system. The diagram in MOTION, p. 450, exemplifies the three species of trochoids.

To suppose the epicycle infinite leads to nothing: but if we now take a trochoidal system, and suppose the rolling circle infinite, we have what is equivalent to a straight line rolling round a circle to which it is always tangent, and carrying a planet at the end of an arm which is supposed fixed to the straight line. If the planet be on the straight line, we have obviously the INVOLUTE of a circle; for the unrolling thread described in the article cited may be considered as the part of the rolling tangent which has been in contact with the circle since the beginning of the motion. If the planet can pass through the centre of the fixed circle, the curve becomes the spiral of Archimedes. These spirals must be made complete by using both positive and negative values of the radius vector. [SPIRAL.] They are not of much use except to the mathematician.

The various classes of trochoidal curves must be studied to aid in forming a proper conception of the effect of combined circular motions: one remarkable instance of their application is that of the apparent motions of the planets. These *apparent* motions must be exactly what would take place if the earth were at rest, the sun revolving in an orbit about the earth, which orbit is the deferent; while the sun itself is the centre of an epicycle equal to that of the planet's orbit, in which epicycle the planet moves. And since the epicycle and deferent are convertible, we may in the case of one of the superior planets use the planet's larger orbit as a deferent, and the sun's smaller orbit as an epicycle. Again, since the planet of the smaller orbit always has the greater angular velocity, the ratio of the epicyclic to the deferential velocity, or n, is always, the smaller orbit being the epicycle, greater than unity. Hence, when the planet is retrograde, the loop of its apparent orbit is always turned towards the earth, so that the apparent magnitude of the planet is always greatest in the middle of its retrogradation. To test these things, we ought to have angles of longitude measured in the plane of the planet's orbit; but since the inclinations of those planes to the ecliptic are not very great (with the exception of the new planets), angles measured on the ecliptic, or longitudes commonly so called, will do as well for illustration.

When the planet begins and ends its retrogradation, the tangent of the apparent orbit passes through the earth, and the planet, moving in that tangent, does not sensibly change its apparent position in the heavens for several days: it is then called *stationary*. The angle between these two stationary points is the angle of retrogradation, for which a formula has been given. But we shall simply notice the general figure of the apparent orbits, giving the ratio of the radius of the deferent to that of the epicycle, when the smaller of the two orbits (sun's round the earth, and planet's round the sun) is the epicycle, and the larger the deferent, and also the ratio of the angular motions.

	$a \div b$	n		$a \div b$	n
Mercury	2·58	4·15	Jupiter .	5·20	11·86
Venus .	1·38	1·63	Saturn .	9·54	28·78
Mars . .	1·52	1·88	Uranus .	19·18	84·01
Small Planets	2·4 to 2·8	3·6 to 4·6			

All these must belong to looped curves, going round for ever, and never reuniting, in consequence of the practical incommensurability of the values of n. The angles of the descent are—for Mercury, $180° \div (4·15 - 1)$ or 57°; for Venus, 286°; for Mars, 205°; for the small planets, from 70° to 50°; for Jupiter, 16°; for Saturn, 6½°; for Uranus, 2¼°. The doubles of these angles will be the angular distances between the lower points of two loops. Thus, to construct the orbit of Mercury, take a deferent of which the radius is about 2½ times that of the epicycle, draw the apocentral and pericentral circles, lay down a succession of radii each at 57° to the preceding, draw the ascents and descents in the manner of the figure in § I., and the result will give a sufficient idea of the orbit for mental purposes. The time of the planet moving from the lower part of one loop to that of the next is, roughly, a revolution in the epicycle; that is, a year of the inferior planet for each inferior planet, and a year of the earth for each superior planet.

In the case of the moon we have a the radius of the earth's orbit, b that of the moon round the earth, $a \div b$ is about 400 and n is about 13; whence, since 13 is less than $\sqrt{400}$, or 20, the moon's real orbit round the sun has neither loops nor flexures, but is always concave to the sun. [MOON.]

The mathematical part of this subject labours under the same disadvantage as the more popular explanation, namely, the adoption of the trochoidal mode of viewing the curves, which, though it gives really the same equations as the planetary mode, embarrasses the question by introducing more complicated formulæ. If we take the line drawn from the centre to an *apocentre* of the curve for the *positive part* of the axis of x, and as before, let ϕ be the deferential angle, $n\phi$ the epicyclic angle, x and y the rectangular coordinates of a point in the curve, r and θ the polar coordinates, a and b the radii of the deferent and epicycle, we have (1

$$x = a\cos\phi + b\cos n\phi, \quad y = a\sin\phi + b\sin n\phi$$

which are the fundamental equations of the curve. Here a and b are both positive, ϕ (and also θ) vanishes at the apocentre, which is on the positive side of the axis of x, and n has its proper sign. But if we place a pericentre on the positive side of the axis of x, other things remaining the same, we have (2)

$$x = a\cos\phi - b\cos n\phi, \; y = a\sin\phi - b\sin n\phi.$$

If the last terms stand thus, (3)

$$x = a\cos\phi \pm b\cos n\phi, \; y = a\sin\phi \mp \sin n\phi$$

they may be reduced to (4)

$$x = a\cos\phi \pm b\cos(-n\phi), \; y = a\sin\phi \pm b\sin(-n\phi)$$

or the case is one of the preceding, the ratio of the velocities being $-n$ and not n. If the first terms be negative, change the signs of x and y, and let the curve thus found make a half revolution: but if the first terms differ in sign, the equation is reduced to one of the preceding cases by changing the sign of ϕ (and of n, if necessary), which shows that what we had was the equation *to* the curve as described by a contrary motion of the deferent. All this however has only reference to the reduction of a particular equation to the form (1), which we shall use throughout. From (1) we readily find

$$r^2 = a^2 + b^2 + 2ab\cos(n-1)\phi \quad . \quad . \quad (5)$$

or the passage from apocentre to pericentre, or from $r = a + b$ to $r = a - b$, is performed, while $\cos(n-1)\phi$ changes from 1 to -1, or $\overline{n-1}\,\phi$ from 0 to π, or to $-\pi$, according as n is $>$ or $<$ 1. We also have

$$\tan\theta = \frac{a\sin\phi + b\sin n\phi}{a\cos\phi + b\cos n\phi} \quad . \quad . \quad (6)$$

To determine the period of retrogradation, if any, we must differentiate the preceding, which gives

$$r^2\frac{d\theta}{d\phi} = a^2 + b^2 n + ab(1+n)\cos(n-1)\phi \quad . \quad . \quad (7)$$

and there is retrogradation when the second side is negative, from whence the formula already given is deduced, and the condition that nb must be numerically greater than a (a being throughout supposed greater than b). The following formula will help to obtain this condition:

$$\left\{\frac{a^2 + b^2 n}{ab(1+n)}\right\}^2 = 1 - \frac{(a^2 - b^2)(n^2 b^2 - a^2)}{a^2 b^2 (1+n)^2} \quad . \quad . \quad (8)$$

From the preceding formula (7), it is easy to obtain $\frac{1}{2}\int r^2 \, d\theta$, the area included between two radii and the curve. But this is subject to the interpretation of that part of the area which is contained between two radial tangents to a loop, and the lower part of the loop being negative: the total result of which is that the area inside the loop is counted twice, and all the rest once.

To find the arc and points of contrary flexure we must deduce the following equations (9, 10):

$$\frac{dx^2}{d\phi^2} + \frac{dy^2}{d\phi^2} = a^2 + b^2 n^2 + 2abn\cos(n-1)\phi$$

$$\frac{dx}{d\phi}\frac{d^2y}{d\phi^2} - \frac{dy}{d\phi}\frac{d^2x}{d\phi^2} = a^2 + b^2 n^3 + ab(n^2 + n)\cos(n-1)\phi$$

The second formula changes sign at the points of contrary flexure, whence the criterion before given is determined, by help of the following (11):

$$\left\{\frac{a^2+b^2 n^3}{ab(n^2+n)}\right\}^2=1+\frac{(b^2 n^2-a^2)(b^2 n^4-a^2)}{a^2 b^2 (n^2+n)^2}$$

The various double points are thus determined. Let ϕ and ϕ' be the two deferential angles belonging to a double point, the first when the curve passes through it the first time, and the second for the second. Since the value of r is the same at both points, we must have $\cos(n-1)\phi=\cos(n-1)\phi'$, whence we have

$$(n-1)\phi'=2k\pi \pm (n-1)\phi \quad . \quad . \quad (12)$$

k being a whole number, positive or negative. If $\pi \div (n-1)$, the angle of descent, be called μ, we have $\phi'=2k\mu \pm \phi$; and if we substitute this in the equations (1) remembering that $n\mu=\pi+\mu$, we find, by ordinary trigonometrical development, that the following equations exist between the coordinates of every double point:

$$x=\cos 2k\mu . x \mp \sin 2k\mu . y, \quad y=\sin 2k\mu . x \pm \cos 2k\mu . y.$$

These two equations should be really the same, and they are so if we take the lower signs, in which case they amount to the following:

$$y=\tan k\mu . x, \qquad \theta=k\mu, \text{ or } k\mu+\pi.$$

If the higher signs be examined, it will be found that the two equations are not identical except when $2k\mu=2l\pi$, l being a whole number, which can be true only when n is a commensurable fraction. But this case being further examined, shows that no double points are indicated, but only that the curve itself is repeated *in all its points* after a proper number of revolutions of the deferent, as is otherwise sufficiently obvious. Consequently all the double points of a trochoidal curve lie in apocentral or pericentral radii, or in the radii opposite to them. Substitute for y and x their values in $y=\tan k\mu . x$, and this equation is easily reduced to

$$a \sin(\phi-k\mu)+b\sin(n\phi-k\mu)=0;$$

from which the values of ϕ which belong to double points answering to different integer values of k are to be obtained by approximation.

The radius of curvature of any trochoidal curve is obtained from the formulæ (9, 10), and is as follows:—

$$\frac{\{a^2+b^2n^2+2abn\cos(n-1)\phi\}^{\frac{3}{2}}}{a^2+b^2n^3+ab(n^2+n)\cos(n-1)\phi}$$

It never becomes nothing except at the cusps of the epicycloid or hypocycloid; nor infinite except at the points of contrary flexure, or at the pericentre in the case of great approach to straightness already alluded to. The equation of the Evolute [INVOLUTE AND EVOLUTE], ξ and η being coordinates of a point in it, is involved in the following equations:—

$$\eta=a(1-\kappa)\sin\phi+b(1-n\kappa)\cos n\phi$$
$$\xi=a(1-\kappa)\cos\phi+b(1-n\kappa)\cos n\phi$$
$$\kappa \text{ being } \frac{a^2+b^2n^2+2abn\cos(n-1)\phi}{a^2+b^2n^3+ab(n^2+n)\cos(n-1)\phi}$$

The evolute, then, of a trochoidal curve may be described as of an extended sort of planetary character, having an epicycle of variable size, and radius $b(1-n\kappa)$, which moves upon a deferent, also of variable size, whose radius is $a(1-\kappa)$. In one remarkable pair of cases this variation of the elements of the evolute ceases, namely, for the epicycloid and hypocycloid. If $b^2n^2=a^2$, we find that κ becomes the constant $2\div(1+n)$, and the equations of the evolute become those of a new epicycloid or hypocycloid, having its vertices at the cusps of the original involute.

The arc of the trochoidal curve cannot be obtained without the previous rectification of an ellipse, except in the case of an hypocycloid or epicycloid. In the former case the arc measured from the apocentre or cusp, formed while the deferential angle ϕ is produced, is

$$\frac{4ab}{a+b}\left(1-\cos\frac{a+b}{2b}\phi\right)$$

and the whole arc of descent is $4ab\div(a+b)$. The same for the epicycloid, the apocentre being now a vertex, is

$$\frac{4ab}{a-b}\sin\frac{a-b}{2b}\phi;$$

the whole arc of descent being $4ab\div(a-b)$. All the preceding formulæ may be reduced to those of the trochoidal form by the general equations before given.

P. C., No. 1588.

The equations of the cycloid and simple trochoids may be, in an article like the present, best deduced from those of the double circular system. Remove the origin from the centre to the circumference of the deferent, we have then for the equations—

$$x=-a(1-\cos\phi)+b\cos n\phi, \quad y=a\sin\phi+b\sin n\phi.$$

Let a increase without limit, and let s be the arc of the deferent, described with a velocity a, while ν is the absolute angular velocity of the planet round the epicycle. We have then $s=a\phi$, and $a : s :: \nu : n\phi$. Substitution gives

$$x=-a\left(1-\cos\frac{s}{a}\right)+b\cos\frac{\nu}{a}s, \quad y=a\sin\frac{s}{a}+b\sin\frac{\nu}{a}s;$$

of which, when a is increased without limit, the ultimate equations are

$$x=b\cos\frac{\nu}{a}s, \qquad y=s+b\sin\frac{\nu}{a}s;$$

which are the equations of the common trochoidal system. Here an epicycle moves up the axis of y with a velocity a, while a planet revolves in the epicycle with the angular velocity ν. When νb is numerically greater than a, there is a curve with loops; when $\nu b=a$, one with cusps; and when νb is less than a, one with undulations and contrary flexures.

To get the equations of the other extreme case, we must reduce the planetary form of the general equations to the trochoidal, which gives

$$x=(F+R)\cos\phi+C\cos\left(\frac{F+R}{R}\phi\right)$$

$$y=(F+R)\sin\phi+C\sin\left(\frac{F+R}{R}\phi\right)$$

Let $C=H-R$: that is, let H be the distance of the planet from the circumference in contact of the rolling circle. Substitute for C, develop

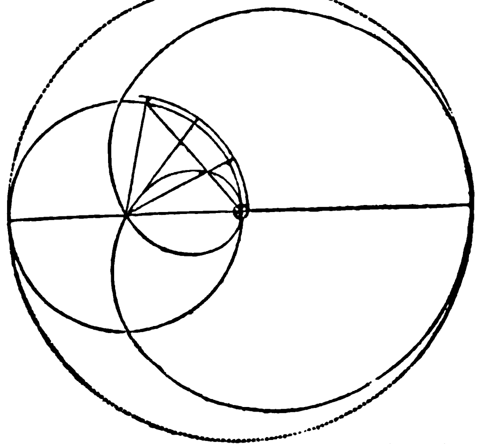
$$R\cos\left(\phi+\frac{F}{R}\phi\right) \quad \text{and } R\sin\left(\phi+\frac{F}{R}\phi\right)$$

into their binomial forms, and then increase the rolling circle without limit. The ultimate equations will be found to be

$$x=(F+H)\cos\phi+F\phi\sin\phi$$
$$y=(F+H)\sin\phi-F\phi\cos\phi$$

Here a tangent rolls over the fixed circle, carrying with it a point attached by a perpendicular arm of the length H. If $H=0$, we have the involute of the fixed circle; but if $H=-F$, in which case the moving point begins from the centre of the fixed circle, we can deduce $r=F\phi$, $\theta=\phi-\frac{1}{2}\pi$, which gives the spiral of Archimedes. We have touched slightly on these extreme cases, but the mathematical student will find it a useful exercise to develop them more fully.

In conclusion, we wish to call attention to the fact that the specimens of curves in this article are all entirely the production of machinery. We are indebted for them to the kindness of Mr. Henry Perigal, of Smith Street, Chelsea, a gentleman whose pursuits are scientific, and who practises the higher branches of turning as an amateur, and has devoted much time and money to the investigation of the effects of combined motions, as shown in the curves



resulting from them. Most of those given in this article were executed in his lathe by means of Ibbetson's geometric chuck, a contrivance the results of which are well known to turners, but which have never been exhibited, as far as we know, in any article professing to give a mathematical classification of them.

The preceding is the curve called the trisectrix in the article Trisection: it is a wood-cut made in the usual way from a drawing made in the lathe; all the rest are cut in the lathe.

TROCHOI'DEA. [Trochidæ.] The genera referred to the title *Trochoïdea* will be more particularly treated of in the article Turbinidæ.

TROCHUS. [Trochidæ.]

TROEZEN (Τροιζὴν or Τροιζήνη), one of the most ancient Greek cities in Argolis. It was said to have been built by Orus, whom Pausanias (ii. 30, 6) considers to have been an Egyptian, but it derived its name from Troezen, one of the sons of Pelops, for before his time its name is said to have been Posidonia. It was situated on the eastern coast of Argolis, fifteen stadia from the sea. The harbour, at the entrance of which lay the island of Calauria, was called Pogon (a beard), whence the Roman proverb 'Troezenem navigare,' to wear a false beard. The town itself lay on a considerable eminence between the sea and the river Chrysorrhoos. Ruins of it are still extant in and about the modern village of Tamala.

Troezen was a sovereign city which had a considerable territory and several small townships. Its wealth and power may be estimated from the fact that in the Persian invasion of Greece the Troezenians joined their countrymen with an army of 1000 men and five ships of war. Their generous conduct towards the Athenian women, children, and slaves who quitted Attica when Xerxes invaded it, reflects honour upon the character of the Troezenians. Their town continued to be of some importance even as late as the time of Strabo, and Pausanias has left us a description of its numerous temples and other public buildings, most of which were filled with costly works of art. (Paus., ii. 31, &c.)

TROGLO'DYTÆ (Τρωγλοδῦται). [Apes, vol. ii., p. 147.] Under the term *Troglodytæ* the antients appear to have comprised more than one race of men. The principal race, that referred to by Pliny (*Nat. Hist.*, v. 8) as excavating caves for habitations, feeding on serpents, and expressing their ideas by inarticulate sounds, 'stridor, non vox,' is placed among the Æthiopians. Again, in the twenty-ninth chapter of the sixth book, treating of the nations near the Red Sea, we find the *Troglodytici* and the *Æthiopici*. The annotator, in the Variorum Pliny (Lugd. Batav., Rotterdami, 1669, 8vo.) states in a note to the chapter last quoted, that a nation of Abyssinians near the Red Sea then went by the name of *Troglodytæ*, and that the kingdom was called *Barnagas* by the natives.

These African Troglodytæ, according to Aristotle and other antient writers who have treated on the subject, lived in caves, and buried their dead in a rather singular manner. They tied the corpse neck and heels together, hung it up, pelted it with stones amid shouts of laughter, and, finally, after having covered it with a heap of stones and placed a horn upon the heap, departed. They made wars for food, and strangled weak and worn out individuals of their own nation with an ox's tail. This mode of disposing of such members of the community was considered a benefit, and the sick were treated in the same manner; for they held it to be the greatest of evils that he who could no longer do anything worthy of life should continue to love it. They hissed rather than spoke, and lived on the flesh of serpents, some of which were found in their country twenty cubits in length, but were so swift that they were able to run down the wild beasts which they hunted. In their territory some placed the Fountain of the Sun, which was tepid in the morning, cold at noon, became warm in the evening, and at midnight poured forth streams of the hottest water.

A general description of the mode of living and of the habitations of the Troglodytæ on the Arabian Gulf (the Red Sea) is given in Strabo (xvi., p. 775, &c.). Their principal occupation was the breeding of cattle, and the highest power was in the hands of a number of chiefs. The men had wives and children in common, with the exception of the chiefs, who had wives belonging to them exclusively. They lived principally upon animal food and no part of an animal, not even its bones and skin were despised as food. They were either naked or were only covered with the skins of animals, and the women tattooed their bodies, and wore necklaces of shells. These general features, and still more the detailed account of their life in Strabo, show that the Troglodytæ were people in the lowest stage of civilization.

Aristotle makes the *Troglodytæ* pygmies, and places them in the marshes whence the Nile flowed, in which locality they with their little horses made war against the cranes.

Cluverius states that the Arabian Troglodytæ possessed the whole left side of the Arabian Gulf, whence the region itself was called *Troglodytica*. In the fourth section of the fifth chapter of the sixth book, in which he treats of the 'Deserts of Libya, the Troglodytæ and Garamantes,' he places the *Troglodytæ* beyond the Libyan Deserts, in the locality called, when he wrote, the Desert *Berdoa*; and he says that the Black Mountain (*Mons Ater*, so called from its sun-burnt appearance) protected the *Troglodytæ* from the south wind; and that beyond them lay the Garamantes, called, when he wrote, the kingdom of 'Borno.' [Bornou?]

The accounts of the almost mere animal life of the 'Boshiesmen,' in South Africa, by Thunberg and others, correspond in some particulars with those related of the *Troglodytæ*.

But there was also in Mœsia a nation called *Troglodytæ*. Cluverius describes the *Peucestæ* and the *Troglodytæ* as inhabiting the lower part of Mœsia. (*Introd. Geog.*, iv. 16 and 17.) Troglodytæ are mentioned in Mauritania (Strab., xvii., p. 828); and on the northern side of the Caucasus. This tribe was well acquainted with the cultivation of corn. (Strab., xi., p. 506.)

The earliest extant account of Troglodytæ is by Agatharchides of Cnidos. (Photius, *Bibliotheca*, c. 250.)

TROGLO'DYTES. [Wrens.]

TROGLODYTI'NÆ. [Wrens.]

TROGON. [Trogonidæ.]

TROGO'NIDÆ, a family of Insessores, or Perching birds, remarkable for the beauty of their plumage.

Brisson's thirteenth order of birds consists of those which have four toes, two before and two behind. The order is divided into four sections: 1, those with a straight bill, comprising the Wryneck, the Woodpecker, and the Jacamars; 2, those with the bill slightly curved, embracing the Barbets and the Cuckoos; 3, those with a short and hooked bill, including the Trogons (*Couroucou*), the *Bout de petun* [Crotophaga], and the Parrots; 4, the Toucans.

Linnæus, in his last edition of the *Systema Naturæ*, placed the genus *Trogon* in his order *Picæ*, between *Paradisea* and *Bucco*, in the body of the work; but, in his *Characteres Avium*, at the commencement of the birds, where he divides the *Picæ* into three sections (1, those with walking feet; 2, those with scansorial feet; and 3, those with gressorial feet), he places *Trogon* in the second section, between *Ramphastos* and *Psittacus*. Latham also places it in the same second section, between *Crotophaga* and the Barbets.

Lacépède makes the second order of his great division *Grimpeurs*, or Climbing-birds, consist of those with a dentilated bill. At the head of this order he places the Toucans, and, between them and the Touracos, the Trogons.

In Duméril's arrangement the Trogons appear in the second family (*Levirostres* or *Cenorhamphes*) of his Climbing-birds, between the Plantain-eaters and the Touracos.

The *Serrati*, or Saw-bills, constitute the second family of Illiger's order *Scansores*, and in that family *Trogon* stands between *Corythaix* and *Musophaga*.

Cuvier, in his last edition of the *Règne Animal*, places the *Couroucous* (*Trogon*, Linn.) between the Barbets (*Bucco*, Linn.) and the *Anis* (*Crotophaga*, Linn.). The subgenus *Tamatia*, among the Barbets, immediately precedes the Trogons. These with other scansorial genera form Cuvier's third order, *Grimpeurs*.

The Trogons stand as the first genus of the Barbets (*Barbus*), the fifth family of M. Vieillot's first tribe, *Zygodactyli*, of his second order, *Sylvicolæ*.

In M. Temminck's fifth order, *Zygodactyli*, the Trogons are placed between *Crotophaga* and *Tamatia*.

In the method proposed by M. de Blainville in 1815 and 1821, and developed by M. Lherminier in 1827, *Trogon* stands in the first subclass (Normal Birds), between *Cuculus* and *Galgulus*.

The *Pogonorhynques*, or Beardy-bills, are the second family of M. Latreille's third order, *Grimpeurs*, and in this family *Couroucou* stands between *Barbican* (*Pogonias*) and *Monassa*.

The families comprised in the order *Scansores* of Mr. Vigors are *Ramphastidæ*, *Psittacidæ*, *Picidæ*, *Certhiadæ*, and *Cuculidæ;* and he observes that the immediate connection of *Ramphastos* with the succeeding group, *Psittacidæ*, is not so evident. These families, he remarks, are placed next to each other by all systematic writers; and he says that he decidedly concurs in the general views which bring them into neighbouring groups. 'But,' he adds, 'at present I am acquainted with no forms which intimately connect them, and soften down the important difference observable in the bills and tongues of these birds. This is one of the greatest chasms which interfere with the continuity of our chain of affinities. I might indeed hazard some suggestions as to the mode in which this difficulty may be solved; but I wish to illustrate the general principles of this inquiry by such facts as are acknowledged, and such inferences as are indisputable, without treading on the unstable ground of conjecture.' At the word 'suggestions' in the paragraph above quoted is a reference to the following note:—'I might particularly mention the *Trogon*, Linn., as a bird, whose bill, serrated, but, at the same time short and hooked, seems to give it a similitude to each of these groups. We know but little of this genus, although it abounds in the Old and New World, and that little is altogether insufficient to afford us any information as to its actual affinities.' (*On the Natural Affinities that connect the Orders and Families of Birds*, in *Linnæan Transactions*.)

M. Lesson, in his *Table Méthodique*, makes the *Trogonées* the fifth family of his fifth tribe (*Syndactyles*) of his second order (*Passereaux*). The *Trogonées* are placed between the *Bucconées* and the *Psittacidées*. (*Manuel d'Ornithologie*.)

Mr. Swainson acknowledges that the *Trogonidæ*, or Trogons, are, in one sense, such an isolated group, that zoologists have been much perplexed in what natural family to arrange them; and he remarks that Cuvier, in placing them near to the Puff-Birds (*Tamatia*), seems to have had some perception of what Mr. Swainson believes to be their true station in nature, although both these groups find a place among his Climbing-birds (*Grimpeurs*). Mr. Vigors, he observes, in his 'Natural Arrangement,' first placed the genus *Trogon* between *Crotophaga* and *Corythaix* with a mark of doubt, but subsequently arranged them near the Parrots. 'The Trogons,' says Mr. Swainson in continuation, 'are abundant in South America; and are, perhaps, one of the most extraordinary genera found in that continent. They are not climbing-birds, nor are they in the least organized for that purpose: they live in the deepest and most gloomy shades during day, when they sit almost motionless on a dead branch: during the morning and evening they are more active; at these times they go into the open parts of the forest, and, taking a shady station, dart upon winged insects, particularly hard-coated beetles; at other times they feed upon fruits, especially on the rich purple berries of the different *Melastomæ*' (Melastomata), 'at which they invariably dart precisely the same as if they were insects capable of getting away! The singular account of these birds given by our hunters first awakened our attention to them in their native regions, and these results have since been fully confirmed by the observations made on those species peculiar to Demerara by Mr. Waterton, a well known and observing field-naturalist. Finally, the Trogons, like the Goatsuckers, have remarkably thin skins; like them, they feed upon the wing; the feet of both are so short and feeble, as scarcely to be of any other use than to rest the body; the bill in both is remarkably short; the plumage in both is soft and loose; both have the mouth defended by strong bristles; and both are most active during twilight. Here then is the point, if not of absolute junction, at least of the strongest affinity yet discovered between the *Caprimulgidæ* and the *Trogonidæ;* and it is thus, as we conceive, that the circle of the *Fissirostres* is formed. We began with the Goatsuckers; and, after tracing their connection with the Swallows, the Swallows with the Bee-eaters, and the Bee-eaters with the Kingfishers, we finally return to the point whence we started.' (*Classification of Birds.*)

In the *Synopsis* of the same work the *Trogonidæ* are placed between the *Halcyonidæ* and the *Caprimulgidæ*, with the following characters:—

Trogonidæ. The Trogons.

Bill short, triangular, strong; the tips, and generally the margins, toothed. Wings very short. Rasorial.

Genus *Trogon*, Linn. Both mandibles with their cutting margins serrated, The two anterior toes united as far as the first joint. Nostrils concealed by bristles. Tarsus entirely feathered. Tropical America. The dentirostral type.

Examples, *Trogon melanurus*, &c.: twelve species in all.

Subgenera.

Harpactes, Sw. Bill stronger: both mandibles deeply notched at their tips, but the margins smooth. Nostrils perfectly naked. Tarsus only half feathered. The anterior toes less united. Tropical Asia. The conirostral type.

Examples, *Harpactes malabaricus*, &c.: six species in all.

Apaloderma, Sw. Bill as in *Trogon*, but the dentations almost obsolete. Feet stronger. The two anterior toes cleft to their base. Africa. The tenuirostral type.

Examples, *Apaloderma Narina* and *Apaloderma Reinwardtii*.

Temnurus, Sw. Bill as in *Trogon*. Tail-feathers forked at their tips; the points diverging. South America. Feet ——? The fissirostral type.

Example, *Temnurus albicollis:* but note, Mr. Swainson remarks that neither M. Temminck nor Mr. Gould, to whose monograph Mr. Swainson refers, mentions anything of the form of the feet, and he says that he is therefore doubtful if this is its true situation.

Calurus, Sw. Bill destitute of serratures. Head (typically) with a compressed and elevated crest. Upper tail-covers enormously developed, and hiding the tail. South America. The rasorial type.

Examples, *Calurus resplendens* and *Calurus pavoninus*.

Under a line, and between the *Trogonidæ* and the *Caprimulgidæ*, are placed the genera *Crypticus*, Sw., and *Prionites*, Ill.; and Mr. Swainson, speaking of *Crypticus*, remarks that it is by this form, as he suspects, uniting to *Lamprotila*, that the circles of the *Halcyonidæ* and *Trogonidæ* are connected (1837).

Mr. Gould's splendid 'Monograph of the Trogonidæ' was finished in 1838; and in the 'Introduction' to that work he observes, that those birds, as their general structure and their habits sufficiently indicate, belong to the fissirostral tribe of the *Insessores*. 'Greatly insectivorous,' says Mr. Gould, "they seize the flitting insect on the wing, which their wide gape enables them to do with facility; while their feeble tarsi and feet are such as to qualify them merely for resting on the branches, as a post of observation whence to mark their prey as it passes, and to which, having given chase, to return. As in all other groups, however, we shall find modifications of the type constituting the ground of generic or subgeneric divisions. . . . If not strictly elegant in form, the Trogons in the brilliancy of their plumage are surpassed only by the TROCHILIDÆ: their splendour amply compensates for every other defect. Denizens of the intertropical regions of the Old and New World, they shroud their glories in the deep and gloomy recesses of the forest, avoiding the light of day and the observation of man: dazzled by the brightness of the meridional sun, morning and evening twilight is the season of their activity.'

Mr. Gould refers to Mr. Griffith's edition of Cuvier's 'Animal Kingdom' for an account of the habits of the Trogons; and the author of that account notices their long attenuated feathers with disarranged and luxuriant barbs as making them appear more bulky than they really are. The feathers, too, are stated to be so feebly implanted that they fall at the slightest agitation, and the skin is described as being so delicate that it will tear upon the slightest tension.

The Trogons themselves are described as solitary birds, extremely jealous of their freedom, never frequenting inhabited or open tracts, and delighting in the silence of deserts. 'The interior of the thickest forests,' says the describer, 'is their chosen abode for the entire year. They are sometimes seen on the summit of trees; but in general they prefer the centre, where they remain a portion of the day without descending to the ground, or even to the lower branches. Here they lie in ambush for the insects which pass within reach, and seize them with address and dexterity. Their flight is lively, short, vertical, and undulating. Though they thus conceal themselves in the thick foliage, it is not through distrust; for when they are in an open space, they may be approached so nearly as to be struck with a stick. They are rarely heard to utter any cries, except during the season of reproduction, and then their voice is strong, sonorous, monotonous, and melancholy. They have many cries, from the sound of one of which their name is derived. All those whose habits are known nestle in the hollows of wormeaten trees, which they enlarge with their bills so as to form a comfortable and roomy residence. The number of eggs is from two to four, and the young are born totally naked, but their feathers begin to start two or three days after their birth. The occupation of the male during incubation consists in watching for the safety of his companion, bringing her food, and amusing her with a song, which, though we should call it insipid, is to her without doubt the expression of sensibility. Some of the Couroucous express the syllable *pio*, repeated many times in succession with a powerful yet plaintive tone. Their accent almost reminds one of the wailings of a child who has lost its way, and it is thus that they cry to each other amidst the silence of the forests. As soon as the young are able to provide for themselves, they separate from their parents to enjoy that solitude and isolation which appear to constitute the supreme happiness of the species. Their aliments are composed of larvæ, small worms, caterpillars, coleoptera, and berries, which they swallow entire. The male, at various ages, the female, and the young differ in their plumage, which has given rise to the institution of more species than are really in existence.'

This succinct but eloquent account appears to be, in the main, faithful; and indeed Mr. Gould states that he is enabled in a great measure to confirm it, from the information which he obtained respecting this group whilst he was engaged upon his monograph. But Mr. Gould adds a few facts in some degree contradictory. His friend Mr. John Natterer, who had many opportunities of observing these birds in a state of nature, informed him that he had seen them, though very rarely, congregating together, and more than one species in company; a circumstance which Mr. Natterer accounts for on the principle that instinct leads them by some migratory movement to abandon one district at a certain season of the year in search of another, where food is more abundant. These migrations, however, Mr. Gould observes, cannot be extensive, inasmuch as their wings are not adapted for a lengthened flight: besides which, every new district of any great extent presents us, he remarks, with its peculiar species; for example, none of the species inhabiting Mexico have been found in the Brazils, and *vice versâ.*

With regard to the *Geographical Distribution* of the Trogons, Mr. Gould says that they appear, on general survey, to be divided between America, including its islands, and the islands of the Indian Archipelago; two or three species only having yet been discovered on the continent of India, and those principally inhabiting the countries bordering the Indian Seas. The great nurseries for these birds in the Old World are, he observes, the islands of Ceylon, Sumatra, Java, Borneo, &c.; while over the whole continent of Africa only a single species has yet been discovered. 'It is in South America however,' continues Mr. Gould, 'that we find the greatest number of species, and those of the most exquisite plumage: nor is this all; for it will be further observed that, in accordance with the great geographical distribution thus pointed out, there exist certain characters common to the species inhabiting each region, which, although not very apparent to the unpractised eye, constitute the basis of generic subdivisions, and doubtless have an influence upon their habits and manners. Between the American species and those inhabiting India and Africa, we not only find this broad line of distinction, but discover moreover that the birds of each country are themselves naturally resolvable into certain minor groups, each possessing its peculiar characters, and each as different in habits as in form.'

Mr. Gould further remarks that the beautiful species of the group to which the subgeneric title of *Calurus* has been applied, distinguished by a redundancy of flowing plumage, are not, as may be expected, so well fitted for flight, or for taking their prey on the wing, as are the more closely-plumed species to which the generic name *Trogon* is now restricted: accordingly Mr. Natterer informed Mr. Gould that the gorgeous birds of the former group tenant the topmost branches of the loftiest forest-trees, clinging beneath them like parrots, and feeding more exclusively on fruits and berries; while, on the other hand, Mr. Gould notices Mr. W. S. MacLeay's statement, that the singular Trogon inhabiting Cuba (the only example of the subgenus *Temnurus*), which approximates to the woodpeckers in the more lengthened form of the bill, in the rigid character of the outer tail-feathers, and in the spotting of the wings, approaches those birds also in its habits, giving a preference to the holes of trees rather than to the branches, from the bark of which it procures the larvæ and various insects which constitute its food.

The habits of the Old World species are much less known than those of the American Trogons; but from the more robust form of their bill and their wide gape, Mr. Gould is inclined to suspect that they feed even still more exclusively on insects than on fruits: independently however of the greater strength of the bill, the non-serration of the edges of the mandibles, and the half-denuded face, they may, Mr. Gould remarks, at all times be distinguished by the rich brown colouring of the backs of the males, and by the entire absence of bars across the outer tail-feathers. With respect to the brown colouring of the plumage, there are, he adds, it is true, one or two exceptions to the rule, but none to the absence of the barring of the tail-feathers when accompanied by the former character.

The subgenera into which the Trogons are subdivided by Mr. Swainson appear to Mr. Gould perfectly natural; and he adds a synoptical table with the species arranged under those subgenera, retaining however the generic name of *Trogon*, universally applied to the whole family in the body of his work.

Previous to the commencement of Mr. Gould's monograph, the number of described species amounted only to twenty-two: to these Mr. Gould has added and characterised twelve others new to science, among which are three additional species of the subgenus *Calurus*, of which two only were previously known, and those were confounded under one name. The total number of species known when Mr. Gould finished his monograph was thirty-four, twenty-three of which are inhabitants of America and its islands, ten of the Indian Islands and India, and one of Africa; but he states in his preface that he has reason to believe that many will yet be discovered, both in the Old and New World, particularly in those remote regions which civilized man has seldom, if ever, visited.

Mr. G. R. Gray makes the *Trogonidæ* the fourth family of the tribe *Fissirostres*, which is the first of his order *Passeres*. The *Fissirostres* are divided by him into subtribes, viz. *Fissirostres Nocturnæ* and *Fissirostres Diurnæ*. The *Trogonidæ* are placed under the second subtribe, between the *Todidæ* and the *Alcedinidæ*, and consist of the following

Genera:—*Priotelus*, G. R. Gray (Temnurus,* Sw.); *Apaloderma*, Sw.; *Harpactes*, Sw.; *Calurus*, Sw.; and *Trogon*, Mæhr.

AMERICAN TROGONS.

The remarkable plumage and shy habits of the Trogons did not escape the observation of the antient Mexicans, in whose mythology one of the species, at least (*Trogon pavoninus*), was celebrated. Another species, the *Tzinitzcan* of the Mexicans, *Trogon Curucui*, Linn., was employed by them, according to Hernandez (c. xliii.), in the fabrication of the figures and pictures (imagines) used on festivals, in war, and in their temples. They were probably kept in one of the two houses which formed the Royal Menagerie of antient Mexico, one of these houses being appropriated to birds which did not live by prey; the other to birds of prey, quadrupeds, and reptiles. Three hundred men, according to Cortes, were employed to take care of these birds, besides their physicians, who watched their diseases and applied timely remedies. Of the three hundred attendants, some procured their food, others distributed it, others took care of the eggs at the time of incubation; whilst others, at certain seasons, picked their plumage—for the king not only delighted in the sight of so many species, but was very careful of their feathers for the sake of the famous mosaic images and pictures, as well as of the other works which were made of them.

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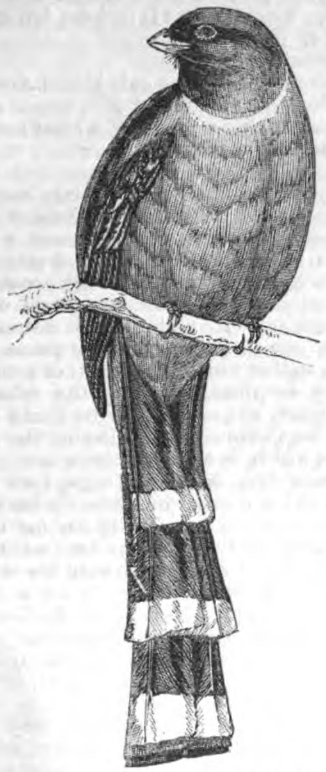
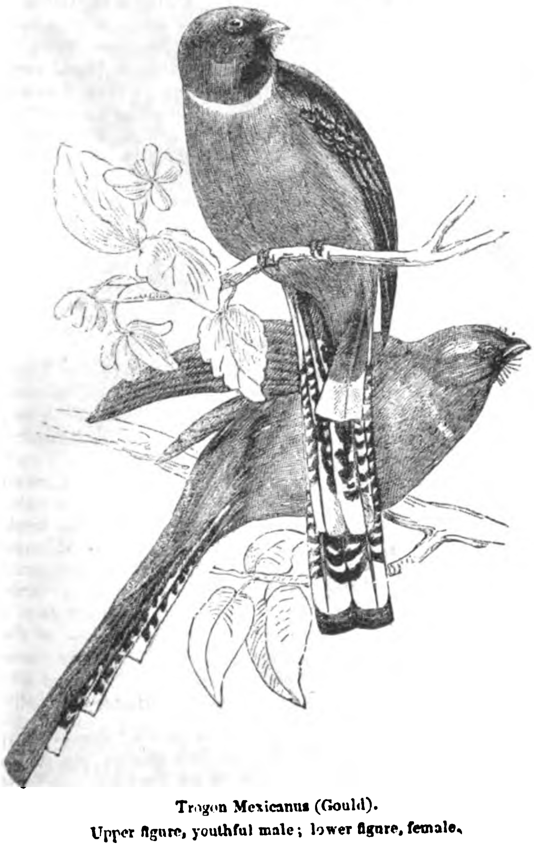
* Previously used in ornithology.

Examples.—*Trogon Mexicanus* (Sw.).

Description.—Old Male.—Beak bright yellow; throat and ear-coverts black, gradually blending with the green which covers the chest and the whole of the upper surface; two middle tail-feathers green, with black tips; the two next on each side wholly black; the three outer on each side black, with white tips; wings black, the whole of which, with the exception of the primaries, is finely dotted with grey; a crescent of white encircles the chest; breast, belly, and under tail-coverts fine scarlet; feet brown. Total length 11 to 12 inches; wing 5¾; tail 7¾.



Trogon Mexicanus (male—Gould).



Trogon Mexicanus (Gould).
Upper figure, youthful male; lower figure, female.

Young Male.—Distinguished from the adult by the grey freckles on the wings being rather stronger, and more inclined to brown on the secondaries; by the extreme outer edge of the primaries being white; and by the tail being regularly barred with black and white, which character is most conspicuous on the outer edges.

Female.—Top of the head, throat, chest, and back dark brown, inclining to olive on the upper surface, and to rufous on the chest; across the chest an obscure band of light grey, the lower part and vent scarlet; wings black, slightly freckled with brown on the outer edges of the secondaries and shoulders; the outer edges of the primaries fringed with white; two middle tail-feathers chestnut-brown, tipped with black; the two next on each side wholly black; the remainder strongly barred with black and white for nearly their whole length; bill yellow, clouded with brown. (Gould.)

Locality.—North of Mexico.

Mr. Gould states that this species is identical with the *Trogon glocitans* of Lichtenstein.

Trogon (*Calurus*) *resplendens*, Gould. *Male.*—Beak gamboge-yellow; head covered with long filamentous plumes, forming a rounded crest; from the shoulders spring a number of lance-shaped feathers, which hang gracefully over the wings; from the rump are thrown off several pairs of narrow flowing plumes, the longest of which in fine adults measure from 3 feet to 3 feet 4 inches; the others gradually diminishing in length towards the rump, where they again assume the form of the feathers of the back—these plumes, together with the whole of the upper surface, throat, and chest, are of a most resplendent golden green; the breast, belly, and vent are of a rich crimson scarlet; the middle feathers of the tail black; the six outer ones white for nearly their whole length, their bases being black; feet brown. Total length from the bill to the end of the tail, 12 to 14 inches; wing 8 to 9; *tarsi* 1; length of longest plume about 3 feet.

Female or Young of the Year.—These have only rudiments of the long plumes, seldom reaching more than an inch beyond the tip of the tail; the feathers of the crest more rounded, and not filamentous; feathers of the shoulders but slightly lanceolate; outer tail-feathers white barred with black, the centre ones black; whole of the chest, throat, and head obscure green, remainder of the upper surface bright green; breast and belly greyish brown; vent fine scarlet; bill black. (Gould.)

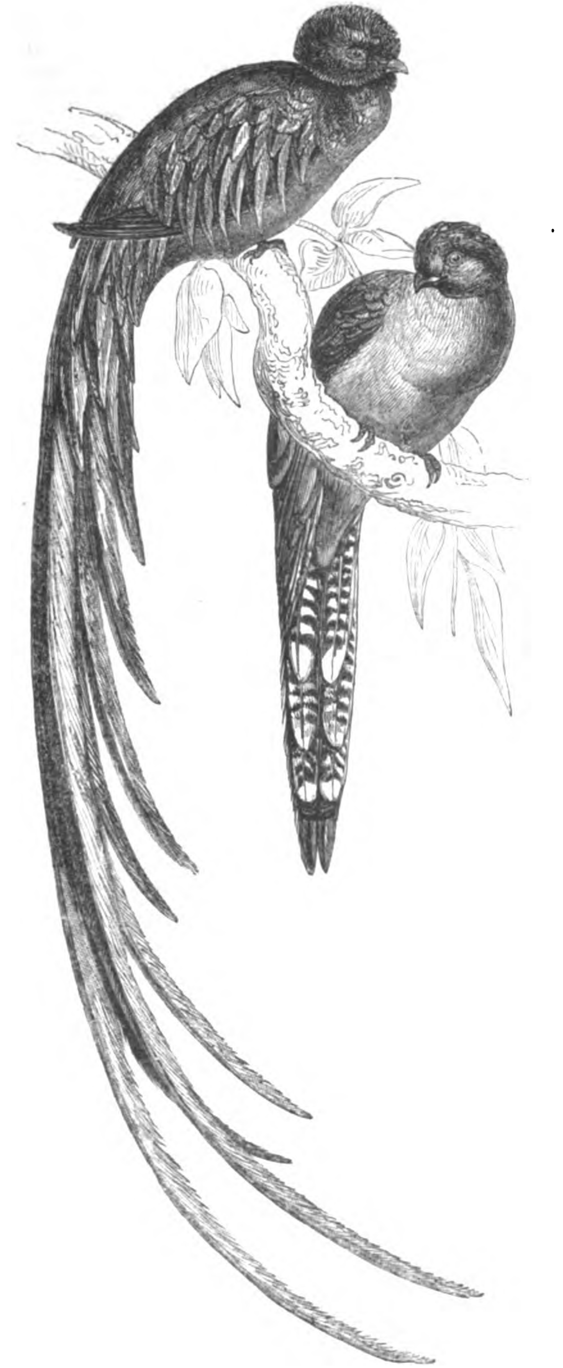
Mr. Gould, after quoting *Trogon pavoninus*, Temm. ('Pl. Col.,' 372) as a synonym, truly observes, that it is scarcely possible for the imagination to conceive anything more rich and gorgeous than the golden-green colour which adorns the principal part of the plumage of this splendid bird; or more elegant and graceful than the flowing plumes which sweep pendent from the lower part of the back, forming a long train of metallic brilliancy.

So rich a dress must be fatally attractive; and, accordingly, we find that this the most beautiful of a beautiful tribe is only found in deep and gloomy forests remote from the haunts of civilized man. This, Mr. Gould observes, may perhaps account for its being so little known to Europeans until within the last few years; for although the long plumes were worn as ornaments by the antient Mexicans, and at a later period sent over by the Spaniards from time to time to Europe, yet it is only very recently that we have become acquainted with the entire bird; and he believes the first perfect example was received by the late Right Hon. George Canning, after whose decease it passed into the hands of Mr. Leadbeater.

It is not improbable that the 'Two feathers of the Phœnix tayle,' mentioned in the *Musæum Tradescantianum* (Lond., 12mo, 1656), were the long feathers of this species, which, once so rare, is now to be found in most collections of any note.

Mr. Gould observes, that the representation in the *Planches Coloriées* of M. Temminck is undoubtedly the first that was published; but he adds, that the author has evidently confounded it with a nearly-allied species discovered in Brazil, and figured in the *Avium Species Novæ*, &c., of Dr. Spix. Mr. Gould feels assured that all those who have noticed it under the name of *pavoninus* will, upon comparing it with the original bird described by Dr. Spix, fully agree with him (Mr. Gould) in considering it as specifically distinct. He is induced to believe that the plumes of the species so named never extend more than a few inches beyond the tail, that the bird has no crest, that the whole of the tail-feathers are black, and that in size it is much inferior to *Trogon resplendens*.

Locality.—Guatemala in Mexico, where it is called *Quesal*. (Gould.)



Calurus resplendens.

Upper figure, adult male; lower figure, female or young male. (Gould.)

AFRICAN TROGON.

Example, *Trogon* (*Apaloderma*) *Narina*. (Le Vaill.)

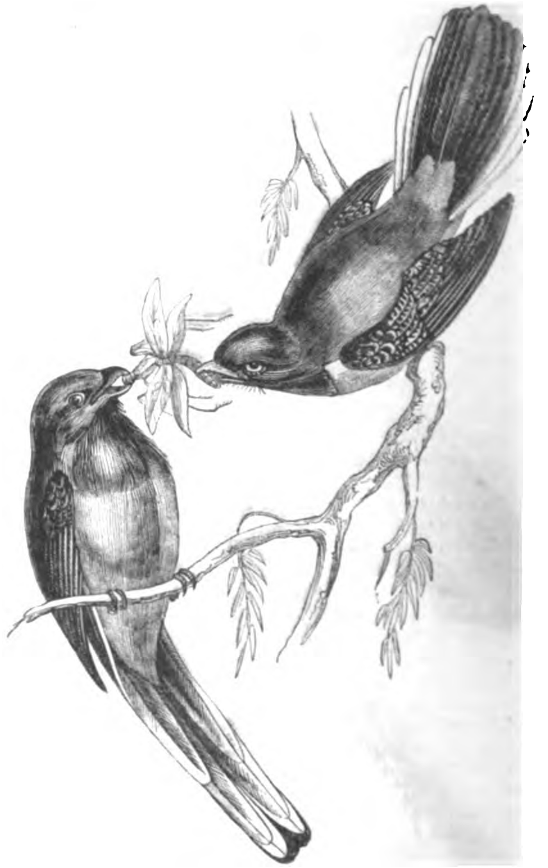
Description.—*Male*.—Bill yellow, with a tinge of blue; whole of the head, throat, chest, shoulders, back, and upper tail-coverts resplendent green; breast and under surface bright blood-red; the wings brown, the greater coverts and secondaries powdered with greyish white, the outer edge of each feather having a tinge of metallic green; two centre feathers of the tail dark purplish green, two next on each side dark olive green, the three outer on each side dark green at their base, largely tipped with white; feet light brownish yellow.

Female.—Upper surface and tail closely resembling those of the male; round the eye and throat rufous brown, becoming paler on the chest, which is slightly tinted with rosy pink; lower part of the abdomen and tail-coverts deep rose-red. Total length 11¼ inches; bill 1⅛; wing 5¼; tail 6⅛; *tarsi* ½. (Gould.)

Locality.—South Africa.

Narina, whose name this the only known African species bears, was a Gonaqua Hottentot girl, whose charms and manners appear to have produced a great impression on Le Vaillant, and he devotes some pages to her in his *Travels*.

Mr. Gould quotes him for information respecting the habits and economy of this bird. Its favourite haunts are the thickest parts of the forest; and there it sits, nearly motionless, on a low dead branch during mid-day: in the morning and evening it captures its food, consisting chiefly of locusts, beetles, and other winged insects, with the addition of caterpillars. Its flight is short and rapid; and it darts from its chosen perch on every passing insect, returning to the station which it had left, or settling near it. Its haunts are described as being in the extensive woods called Autemiquoi, and in those on the banks of the Gamtoos River in the Caffre country. During the pairing season the male, which is at other times mute, utters frequently a melancholy cry. The eggs, four in number, nearly round, and of a rosy white hue, are laid in a nest in the hole of a tree, and the female sits for twenty days. The account given of the young is extraordinary; for we find it recorded, that '*the moment* they are excluded they take flight, and follow their parents for a considerable period.'



Apaloderma narina, male and female. (Gould.)

This, if correct, is a rare instance of perfect development among the *Insessores*. We know that the young of the Gallinaceous birds will run as soon as they have left the shell; but their plumage is most imperfect, and it takes a long time to develop the feathers which are to sustain them in flight; whilst in the bulk of Insessorial cases the nestling is hatched with scarcely anything more than a rudimentary down. The Humming-Birds (see the article) attain their plumage more quickly than most perching birds, and fly after their parents at the first essay; but they are born blind, and are unable to leave the nest for some days. The general account in Griffith's Cuvier above noticed (p. 292), to the correctness of which Mr. Gould bears testimony, is entirely at variance with the particular assertion relative to the Narina Trogon; for the young Trogons are there stated to be hatched entirely naked.

Asiatic Trogons.

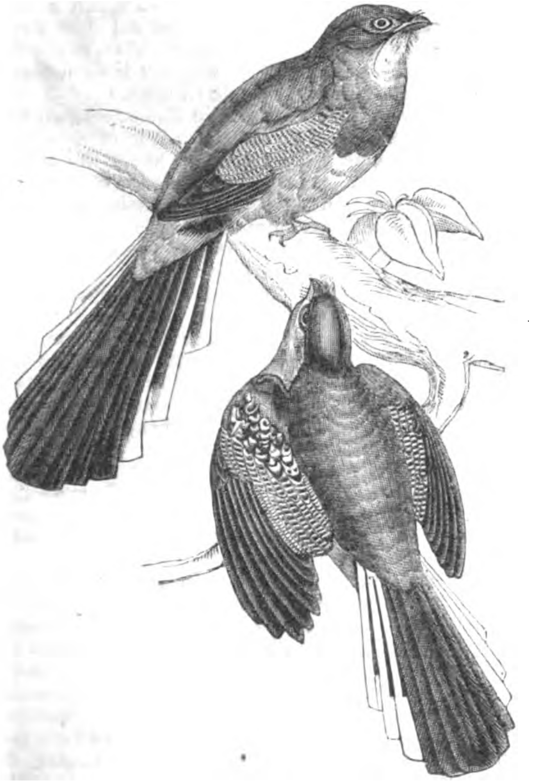
Example, *Trogon* (*Apaloderma*) *Reinwardtii.* (Temm.)

Description.—Bill bright reddish orange; top of the head, back, and upper tail-coverts dark green; six middle tail-feathers black, with green reflexions; the bases of the three outer feathers on each side the same colour as the middle ones, the remaining portions being white; centre of the wings and shoulders green, transversely rayed with fine lines of yellow; primaries black, with the exception of the outermost web, which is white; throat yellow; ear-coverts, sides of the neck, and chest olive-brown; belly and under surface yellow, becoming rich orange on the sides; tarsi yellow; bare skin round the eye blue. Total length from 12½ to 13½ inches; tail 7½; wing 5½.

Young.—Similar to the adult, particularly in the colours of the back and tail, a circumstance, observes Mr. Gould, which rarely occurs in the family, as in all the Trogons where the plumage of the female differs much from that of the male, the young birds generally resemble the former; while, as in the present case, where the sexes are nearly alike, the young partake of the adult colouring, differing only in the markings of the wings and the rufous brown tint of the breast. (Gould.)

Locality.—Java and Sumatra, where it was discovered by Professor Reinwardt, whose name it bears.

This, Mr. Gould observes, is a scarce bird in cabinets of natural history, and he attributes its rarity to its being very local, remarking that the vast collections brought to this country by Sir T. Stamford Raffles and Dr. Horsfield did not contain an example.



Apaloderma Reinwardtii: upper figure, adult male; lower, young bird. (Gould.)

TROGO'NOPHIS, Professor Kaup's name for a genus of reptiles, placed by MM. Duméril and Bibron among the *Chalcidian Lizards*, under the *Acrodont Glyptoderm Cyclosaurs.*

Generic Character.—Teeth solidly fixed on the edge of the jaws, nearly all united together at their base, unequal, conical, blunt or tuberculous, a little compressed, and of unequal number in the intermaxillary bone. Nostrils lateral, small, oval, each pierced in a single plate, the naso-rostral one. No limbs. No præanal pores.

The cephalic plates in the only known species are not numerous, and are disposed as in the greater number of *Amphisbœnæ.* Two of these plates cover the eyes, which in all the species of the subfamily of Glyptoderm Cyclosaurs are entirely deprived of palpebral membranes. The compartments on the surface of the skin are nearly of the same form and size on all the parts of the body, differing thus from the Lepidosterns, on whose breast there is one of a different figure and larger proportion than on the other regions of the animal. There are no crypts on the edges of the cloaca.

Example, *Trogonophis Wiegmanni*, Kaup (*Amphisbœna elegans*, P. Gerv.). *Localities.*—Algiers, Bona, and Oran.

TROGUS POMPEIUS, a Roman historian who lived about the time of Augustus. He was descended from a Gallic family of the Vocontii; and his grandfather, who likewise bore the name of Trogus Pompeius, had served in the war against Sertorius, and received the Roman franchise, probably together with the name Pompeius, through the influence of Cn. Pompeius. His father's brother had been commander of a division of the Roman cavalry in the war against Mithridates, and his father had served under Julius Cæsar, by whom he was afterwards employed as private secretary. Besides these general statements furnished by Justin (xliii. 5: compare Justini *Praefatio*), we know nothing about Trogus Pompeius, except that he is called 'a man of antique eloquence and a most grave author.'

He was the author of a Universal History from the time of Ninus, king of Assyria, down to the year 5 B.C. It bore the title 'Historiae Philippicae et totius mundi origines et terrae situs,' and consisted of 44 books. The original work is now lost, and the only means we have of judging of its merit is an abridgement made by Justinus, which is still extant; and from this it is clear that the author founded his work on the best historical authorities that then existed. The name 'Historiae Philippicae' was probably chosen because the great body of the work, from book 7 to book 41, contained the history of Macedonia and of the kingdoms that were formed out of the great Macedonian empire, as the founder of which Philip was regarded. The usefulness and convenience of Justinus's abridgement, although it is very unequal in execution, has probably been the cause of the loss of the original work. The geography on which Trogus had treated at some length is entirely lost, as the epitomizer has excluded it from his work. Pliny (*Nat. Hist.*, vii. 3; xi. 94) and some other writers mention a work by Trogus on animals, which is entirely lost.

(Vossius, *De Histor. Lat.*, p. 98, &c.; Bähr, *Geschichte der Röm. Lit.*, p. 409.)

TROIS RIVIERES. [Canada, p. 214.]

TROITZK is a town in the government of Orenburg in Asiatic Russia, situated on the right bank of the small river Ai or Ui, in 54° 10′ N. lat. and 61° 20′ E. long., 490 miles from Orenburg. The river Ai forms the frontier of the government towards the steppe of the free Kirghises belonging to what is called the Middle Horde. The town is surrounded with a wall and moat, and contains about 600 houses, with 3000 inhabitants. The public buildings are the cathedral, two mosques, a custom-house, a prison, the barracks, and a school. On the opposite side of the river (over which there is a bridge) stands the bazaar, a wooden building in the form of an oblong parallelogram: the shops are very dark, receiving no light except through the open doors. It is divided by a line of shops from end to end, into two halves; one half is called the Kirghise Bazaar, the other half is similarly divided into two squares, one called the Bokharian, the other the Russian Bazaar. There are only two narrow gates or doors, one leading to the steppe, the other to the bridge across the river to the town. In the Kirghise Bazaar the men, in shabby variously-composed and patched dresses, are seen with camels and horses; the women on saddled cows. The men are chiefly engaged in the sale of horses and oxen, and the women in that of to Ruyter for bringing him off when he had engaged himself too far.

A descent on the coast of France was projected by the States, and Tromp was appointed to carry it into execution. He sailed on this expedition from the Texel on the 17th of May, 1674: the land forces were commanded by Count Horn. They were disembarked at Belle-Isle, but returned on board without effecting anything, the fortress having been judged impregnable. They were afterwards landed at Noirmoutier, where they merely levied some contributions. Tromp then proceeded to Cadiz, where he took charge of a merchant fleet, and convoyed it in safety to the Texel.

In 1675 Tromp visited England, and was created a baron by Charles II. In 1676 he was despatched with a fleet to assist the king of Denmark in his war with Sweden. The king, for his services, conferred upon him the order of the Elephant, and the rank of Count. Count van Tromp, on his return to Holland, was appointed lieutenant admiral-general of the United Provinces, a post left vacant by the death of Ruyter. He accompanied the prince of Orange in the expedition against St. Omer. After this he retired from public life, and continued in retirement till 1691. He was induced in that year to accept the command of a fleet destined to act against France, but died at Amsterdam on the 21st (some say the 29th) of May, before its equipments were completed. He was interred at Delft. His professional eminence was beyond question, though in that point of view he was scarcely equal to his father; while both as a man and citizen he was in worth far inferior to him.

TROMSÖE. [Trondhiem.]

TRONA, the African name for native sesquicarbonate of soda. [Sodium.]

TRONCHIN, THEODORE, was born at Geneva in 1709. His father was of noble family, but was ruined in 1721 by some financial speculations, and in 1727 was obliged to send his son to England, where he was placed under the care of his relative lord Bolingbroke, who sent him to study at Cambridge. Shortly afterwards, he went to Leyden to study medicine under Boerhaave. In 1731, at the conclusion of his medical studies, he settled as a physician at Amsterdam, where he was appointed inspector of hospitals, and married a grand-niece of John de Witt. In 1750 he returned to Geneva, and was appointed honorary Professor of Medicine. In this office, though no duties were necessarily connected with it, he delivered lectures, which were very numerously attended. But he obtained his chief renown by his support of the practice of inoculation for the small-pox, the propriety of which was at that time much discussed. He became the most celebrated inoculator of his day. In 1756 he was called to Paris to inoculate the children of the duke of Orleans, and in 1765 to Italy to perform the same operation on those of the duke of Parma, who conferred patrician rank upon him, and made him his first physician. In the same year the duke of Orleans appointed him his physician, and he went to reside in Paris, where he soon obtained a very extensive practice. He was a man of cultivated mind, and of very pleasing appearance and address, qualities which probably, more than any great amount of medical knowledge, gained for him a very high repute, both during his life and for some years after his death. He was especially celebrated for his success in the medical management of women and children; and his practice, as far as it is recorded, seems to have been guided by good judgment and common sense. He was, moreover, a kind-hearted and charitable man, devoting two hours in every day to giving advice and money to the poor. He was a member of the chief learned societies of Europe. He died at Paris in 1781.

The only published works which Tronchin has left are two theses—'De Nympha,' Leyden, 1736, 4to., and 'De Colicâ Pictonum,' Geneva, 1757, 8vo.; some observations on Ophthalmia and Hernia, in the 5th volume of the 'Mémoires de l'Académie de Chirurgie;' and an edition of the Works of Baillou.

(Condorcet, *Eloge*, in the *Histoire de l'Académie des Sciences de Paris*, 1781.)

TROND (or TRON), SAINT, is an inland town in the province of Limburg in the kingdom of Belgium, in 50° 50′ N. lat. and 5° 12′ E. long. It is situated on the Mesebeck, on the high road from Brussels to Liege, where there was formerly a celebrated Benedictine abbey, founded in the seventh century. It was once a place of considerable strength, but the fortifications were razed in 1675. The population is something above 8000; the inhabitants manufacture a considerable quantity of lace, and there is an important manufacture of firearms. Near this place, at the village of Neerwinder, Marshal Luxembourg gained a victory in 1693 over King William III. of England; and in March, 1793, there was a sanguinary battle between the French under General Dumourier, and the Austrians, commanded by the Prince of Saxe-Coburg, in which the former were totally defeated.

(Hassel, *Geographie*; Cannabich, *Geographie*; Stein, *Handbuch der Geographie*, edited by Hörschelmann.)

TRONDHIEM, more commonly known by the name of *Drontheim*, but in the country itself pronounced *Tronyem*, is the most northern of the provinces of Norway, extending from 62° N. lat. to 71° 10′ N. lat. It lies between 5° and 31° E. long. Near its southern boundary it extends more than 200 miles from west to east, but between 65° and 69° N. lat. its width hardly ever exceeds 60 miles. North of 69° however it grows wider, and in some places the width amounts to 150 miles. On the west and north it is bounded by the sea, on the east are Russia and Sweden, and on the south the Norwegian provinces of Christiania and Bergen. Its area is stated to be about 60,000 square miles, so that it exceeds a little that of England, Wales included.

Trondhiem comprehends the countries situated on the northern declivity of the Norrska Fiellen, and those which lie on the western and steeper slope of the Kiölen Mountains: the greater part of it is exceedingly mountainous, and very little fit for agricultural purposes. This circumstance, united to the severity of the climate, must be considered as the cause of its very small population. A few years ago the whole population did not exceed 300,000 individuals, which gives only 5 persons to the square mile. Trondhiem is divided into three sections, Proper Trondhiem, Nordland, and Finmarken.

Trondhiem Proper comprehends the countries enclosing the Bay of Trondhiem, or Trondhiem Fiord. Among the numerous inlets by which the rocky coast of this country is indented the Trondheims Fiord is the most important. Its entrance from the sea is near 63° 30′ N. lat., and it runs about 60 miles inland, measured in a straight line; but as it forms, as it were, the section of a circle, its whole length measured is near 90 miles. Towards its eastern extremity it is divided into three arms by an island (Ytteröe) and a peninsula, and these arms are called, from south to north, Verdals Fiord, Ytteröe Fiord, and Beitstad Fiord. Beitstad Fiord is united to Trondhiems Fiord by a narrow channel about 5 miles in length. The width of Trondhiems Fiord varies in general between 3 and 5 miles, exceeding these dimensions only where short arms branch off from the main body of the fiord.

The Country South of Trondhiems Fiord lies on the northern declivity of the Lang Field and Dovre Field, which are portions of the Norrska Fiellen. [Norrska Fiellen.] The coast-line extends from Cape Stadtland, the most southern extremity of the province, to the entrance of Trondhiems Fiord, nearly due north-east. It is, more than any other part of the Norwegian coast, intersected by arms of the sea, which do not, as is the case farther south, run in straight lines from the sea inland, but extend in different directions, so that a portion of the country near the sea is converted by them into islands, whilst the remainder forms numerous peninsulas. The largest of the islands thus formed are towards the north, nearly opposite Trondhiems Fiord, and are called Froyen, Hitteren, and Smölen. Hitteren is nearly 30 miles long, and on an average 10 wide. These islands are rocky and high, but not mountainous, the heights on them rising only to the elevation of hills. Their soil is indifferent, and agriculture is limited. But they are partly covered with woods, in which deer are common. The islands which lie farther south and nearer the coast are in general much more elevated, and the summit of that of Tusteren, south of Smölen, probably exceeds 4000 feet above the sea-level, as it is hardly ever free from snow. The coast of the mainland is high, and usually rises with a steep precipice from the sea to an elevation of a few hundred feet. Cape Stadtland is between 700 and 800 feet high, and its southern side is a line of precipices. The peninsula which lies south of the entrance of Trondhiems Fiord is nearly as elevated. Along the whole of the outer coast no tracts of cultivable ground of any extent are met with, and the few hamlets which occur are inhabited by fishermen. The rocks are mostly bare, and in a few places only are there small woods of stunted trees, or rather bushes. A small number of sheep and goats find pasture on them. The fish taken along this coast are chiefly lobsters, cod, ling, and herring, and they constitute the principal article of foreign trade in this part of Norway. The fiords themselves penetrate to the distance of 50 miles from the open sea. Their average width varies between 1 and 2 miles, and they are very deep, but much exposed to sudden gales from the mountains, which, though of short duration, are extremely violent. Along the shores of these inlets tracts of cultivable land occur, but they are of moderate extent. They are cultivated, and yield most kinds of grain, except wheat, and several kinds of vegetables. The mountains and high hills, which separate the fiords from each other, descend with a gentle declivity, which is partly covered with woods of birch, elm, fir, and pine, among which however forest-trees are not common, and is partly used as pasture-ground.

The interior of the country is occupied by the mountain region of the Norrska Fiellen. The highest part of it lies along the southern boundary-line of Trondhiem, where the Snee-hätten (snow-hat) rises to 7489 feet above the sea-level. There are numerous other peaks dispersed over the country, which are always covered with snow. But the base on which they stand is a mountain-plain, whose surface is from 3000 to 4000 feet above the sea. Its surface is uneven, partly owing to the numerous peaks, and partly because there occur many flat and tolerably wide depressions: this table-land is unfit for agriculture, as it is only partially free from snow during two or three months of the year. At that season a portion of it is used as pasture-ground. In some parts are small woods of stunted birch and willows, but in general it is destitute of wood. The most desolate portion of this table-land extends from the east of the Snee-hätten nearly due north, terminating at the entrance of Trondhiems Fiord with the lofty promontory of Walsetholm. On the west of this tract the table-land is furrowed by a few valleys of considerable length, whose width however never exceeds one mile. These valleys are in their lower districts from 2000 to 4000 feet below the adjacent mountains. They have the advantage of a very hot but short summer, and the greatest part of them is cultivated with much care, and yields abundant crops of rye, barley, potatoes, and flax. The produce of these valleys supplies that portion of the population which is employed in fishing, with grain and other provisions; but it is not sufficient, and a part of the necessary supply is imported from other countries. The largest of these valleys are, from south to north, Romsdalen, which is famous for its picturesque beauty, Eikidalen, and Drivdalen. As this country does not offer anything to the foreign market, except fish and some timber, it has only two small towns, Christiansund and Molde. Christiansund lies south-west of the elevated island of Tusteren, and is built on three small islands, enclosing a narrow arm of the sea, which constitutes its harbour. It contains about 3000 inhabitants. Molde, south-south-west of Christiansund, has only 1500 inhabitants. The inhabitants are partly engaged in commerce, but the greater number in the fishery of the Lofoden, to which these towns send a number of small vessels. Their commercial relations are almost exclusively with Spain, to which country the produce of the fisheries is sent.

The country along the southern shores of Trondhiems Fiord contains a much greater portion of arable land, and is more extensively cultivated and more populous. It is watered by four rivers, which, from west to east, are called Oerkel, Guul, Nid, and Stor-elf. From the shores of the fiord to the Dovrefield the country rises in three terraces, whose lines of separation are marked by the Lake Salböe, which is about 520 feet above the sea, and the course of the river Guul, where it runs from east to west. Each of the terraces occupies about 20 miles in width. The lowest terrace, along the shores of the fiord, is an undulating plain about 9 or 10 miles in width, which is however intersected with a few steep rocks. A large portion of it is cultivated, though the soil is not fertile. Near the lake of Salböe, and in general about 10 miles from the fiord, the country becomes hilly, and the soil is stony. Only a small portion of it is under cultivation, and the remainder is indifferent pasture-ground. The second terrace is broken in all its extent, with the exception of the river valleys, which are from 1 to 3 miles wide, of considerable fertility, and well cultivated. The high hills and mountains which lie between the valleys are almost overgrown with pine, fir, birch, and other trees, and in some parts contain excellent pasture, whilst at others it is indifferent. The third terrace rises by degrees from 1500 to 3000 feet, and partly resembles the table-land above mentioned, which lies farther west, but its surface is broken by numerous rivers, which descend from the Dovrefield, and in some of the narrow valleys along their banks cultivation is carried on to some extent, whilst the adjacent mountains afford good pasture for several months of the year. There are about twenty-three individuals to each square mile of this region. Its commercial produce is exported from the town of TRONDHIEM. Respecting the roads which lead from this country to Christiania, Röraas, and Sweden, see NORRSKA FIELLEN, vol. xvi., p. 284.

The small district of Röraas lies on the Dovrefield, close to the boundary of Sweden, and comprehends the country in which the Glommen-elf originates. It is much elevated above the level of the sea, for the lake Oresund, which may be considered as the source of the Glommen-elf [NORWAY, vol. xvi., p. 325], is more than 2400 feet, and the town of Röraas about 2200 feet above the sea. The country surrounding it is unfit for agricultural purposes, on account of the cold of the climate; the frost sometimes even in June kills the animals on the pastures. In this tract three copper-mines are worked with success. The ore from them is brought to the town of Röraas, where the smelting-houses are built. This town contains a population of about 1500 individuals, all of whom are employed in the mines or smelting-houses. The copper is carried to Trondhiem, where it is shipped. In the most elevated part of this tract are a few families of Laplanders, who live on the produce of their herds of rein-deer.

Country North of the Trondhiem Fiord.—An immense mass of high rocks extends along the sea from the shores of the fiords to the mouth of the Namsen-elf. A great part of it rises above the line of trees, and it is considered by Von Buch as the most elevated mountain of Scandinavia in this parallel; for the great range which divides Norway from Sweden is here interrupted by the remarkable depression which is noticed in NORRSKA FIELLEN, vol. xvi., p. 284. This mountain mass, called Oiskavelen Field, is unfit for any purpose. East of it is a wide depression, but little elevated above the level of the sea, which extends 14 miles from the shores of Beitstad Fiord to the valley of the Namsen-elf. It is called Nummedalen, and a part of it is cultivated, but the greater portion of it is covered with a forest of fine timber-trees. The same description applies to the valley of the Namsen-elf, which is contiguous to Nummedalen on the north. The forests covering this country are the most northern large forest of timber-trees in Norway, and from Namsenfiord all the countries lying farther north are supplied with logs and deals. All the way to Vardoëhuus, and even to Kola in Russia, scarcely a house or a church is found which is not built of logs from Namsen. The Namsen-elf is the largest of the rivers of Norway which drain its western districts and fall into the North Sea. It is too rapid to be navigable for boats, but timber is floated down. Along the whole coast of Trondhiem Proper the rocks, partly above and partly below water, are so numerous, that the navigation of this sea is extremely dangerous. In some parts the sea is literally dotted with such rocky islets, especially to the north of the island of Froyen, where a space of sea exceeding 200 square miles is covered with them, and in the vicinity of the three islands of Vigten.

Nordland comprehends all the countries lying between the parallel of the island of Leköe and the Quaenanger Fiord. The southern part is called Helgeland, the central district Salten, and the northern portion Tromsoe. The islands of Lofoden and of Senyen are also included in it.

Helgeland extends from the parallel of the island of Leköe to Cape Kunnen. The Kiölen range is in these parts not more than 60 miles distant from the sea. The coast here also is rocky, but of moderate elevation, much lower than farther south or north. It has likewise numerous inlets, but they are short, only a few exceeding 10 miles in length. Numerous islands, islets, and rocks line the shores. Some of the islands rise to a great elevation, as

Torgehatten (2000 feet), Alsten (4260 feet), Dönnaöe (3200 feet), and Luröe (2187 feet). These are unfit for agricultural purposes, and only inhabited by a few fishermen. Other islands are low, and have some farms for breeding cattle, rather than for cultivation. Among these is Tiötöe, which is mostly under cultivation, and on which the small town of Alstahong is built. The interior of Helgeland is filled up by mountains rising from 1000 to 1500 feet, between which occur numerous narrow valleys and depressions, which in general are well wooded, though the trees rarely attain the size of timber-trees. There is however a moderate portion of land which could be cultivated; but in this tract agriculture is neglected because fishing is much more advantageous. In the valleys of the two rivers Vefsen and Ranen however rye, barley, and potatoes are cultivated with success. The principal branch of fishery is that of the herring, and two-thirds of the large quantity which is exported from Bergen are taken on this coast. This fishery lasts from August to the end of the year. Near the polar circle and north of the valley of Ranen an extensive and elevated mountain-mass lies across the country, and terminates on the sea with Cape Kunnen, which constitutes a remarkable feature in this part of Norway. It rises from the edge of the water with perpendicular precipices to more than 1000 feet above the sea, and at a short distance from the sea it is 2000 feet high, and in a course of 4 or 5 miles it attains more than 4000 feet. The more elevated portion is always covered with snow and ice.

Salten comprehends the country between Cape Kunnen and Ofoden Fiord (68° 30′). The Kiölen range here approaches nearer to the sea, being hardly in any part 40 miles distant from the shore. At the same time it rises in elevation, for the Sulitelma is 6155, and Mount Ankenäs 4880 feet above the sea. The space between the Kiölen and the sea is filled up by peninsulas, and wide and deep inlets. The peninsulas are formed by high ridges of rocks rising with frightful precipices on both sides, and terminating at the top with a sharp ridge, in most places scarcely sufficient to afford a resting-place for a bird. The inlets penetrate so far into the land, that most of them wash the very base of the mountain-range. Salten is the most desolate part of Norway. The steep sides of the mountains are nearly bare of vegetation. The small depressions which occur here and there are partly filled with swamps, and partly overgrown with stunted birch, pine, and fir. Even firewood is in most places scarce. The pastures are small in number and extent, and the cattle of very diminutive size, the cows not larger than a Newfoundland dog, and the sheep resembling large cats. Cultivation is limited to a low tract of moderate extent, which occurs near the sea between Saltens-fiord and Foldenfiord, and on which the small town of Bodoë is built, which contains about 300 inhabitants. Only barley and potatoes are grown here. The inhabitants of Salten are few, and they derive their subsistence almost exclusively from the fishery on the Lofoden Islands.

The *Lofoden Islands* lie opposite the coast of Salten, and are divided from it by an arm of the sea called West Forden, which at its southern extremity is nearly a hundred miles wide, but narrows in advancing northward, until, at its most northern extremity between the continent and the island of Hindöen, it terminates in a strait hardly two miles across. The Lofoden Islands constitute a rocky chain, which near the continent runs nearly due west, but farther to the west declines to the south-west. The islands and islets of which this chain is composed are separated from one another by narrow straits, through which the sea flows during the tides with a rapidity resembling a torrent. In some parts it forms very deep and extensive eddies, among which the whirlpool called the *Malström*, and which is found between the islands of Moskenäsöe and Mosköe, has obtained celebrity, as it is impossible to navigate it during the strength of the tides, and it has caused much loss of life. All the islands are rocky, with high shores: those however which lie most to the westward rise only to a moderate elevation. The largest of them are Varöe, Moskenäsöe, Flagstadöe, and West Wagöe. East Wagöe rises to 3000 feet above the snow-line, and Hindöe to 3200 feet. The mountains however, except where their sides are too steep, are covered for a few months of the year with a vigorous growth of grass, which supplies good pasture for a few cattle and sheep of diminutive size. In winter these animals live mostly on the heads and guts of fish, and on different kinds of sea-plants. On West Wagöe a few small horses are kept. The population of this group is stated not to exceed 8000 individuals; but during the fishing season these islands are visited by between 3000 and 4000 boats, each manned by four to five persons, and by 300 yachts from Bergen, Christiansund, and Molde. Particulars respecting this important fishery are given under Bergen, vol. iv., p. 272 to 274.

Tromsöe extends from Ofoden Fiord to Quaenanger Fiord (70° N. lat.). Opposite the termination of the Lofoden islands, the chain of the Kiölen, forming the watershed, recedes farther inland, and runs nearly east. In these parts this chain grows much lower, and it does not appear that any portion of it is above the snow-line. The highest mountains are some distance from the range on the shores of the sea and of the fiords. The Faxfield (near 69° N. lat.) rises to 4260 feet; and the mountains enclosing Malanger, the Storhorn near Tromsöe, and the ranges on Lyngenfiord, are nearly as high. The last-mentioned are the highest mountains between 69° and 72° N. lat. Large tracts of them are always covered with snow, and glaciers descend down on their sides. The deep and extensive fiords by which this country is indented have level tracts on their shores, which are of some extent near the innermost recesses of the inlets; and though the climate is very severe, cultivation is carried on with tolerable success on these flats, especially in Balsfiord, Lyngenfiord, and Reisfiord, where considerable quantities of barley and potatoes are raised. A part of the mountains is covered with woods, which contain a few timber-trees, so that logs and deals are exported. The pastures are much more extensive and richer than in Salten, and cattle and sheep are more numerous. Near 69° 30′, the town of Tromsöe has been built on an island situated in the strait between the continent and the island of Hvalöe (Whale Island). The island on which the town stands is from four to five miles in length, and rises to the height of about 600 feet. The town contains about 800 inhabitants: it has some good houses, a saw-mill, and wooden quays along the harbour. It is a thriving place. The mean annual temperature does not exceed 32°.

Opposite Tromsöe are the Senyen Islands, so called from the largest of them. Senyen is very rocky, but not high, except towards the north-western extremity. Hvalöe rises to 2000 feet, and Ringsvadsoe is too high to be inhabited. The other islands are comparatively small, but also very high. On the two first-named islands are extensive pasture-grounds, and a few spots are cultivated. The inhabitants however derive their subsistence almost exclusively from the fishery. Cod, halibut, and smelts are taken in large quantities.

Finmarken comprehends the most northern portion of Trondhiem, extending from Quaenanger fiord to the Tana-elf and Varanger fiord. Along its western side, between Quaenanger fiord and Alten fiord, extends a mountain-range, which terminates near the sea in the isolated Yekulsfield, rising 3700 feet above the sea, the most northern glacier (70° N. lat.). The country east of this range contains a more elevated and a lower region, of which the former lies to the north and the second to the south. The boundary-line between them runs along the Alten-elf from Kautokeino to Maasi, nearly south and north, and from Maasi to the innermost corner of the Tana fiord. The highest mountains of the elevated region are found at the most northern extremities of the long peninsulas that lie between the gulfs or fiords of Alten, Porsanger, Laxa, and Tana. They stand mostly isolated, and are divided from each other by valleys, which are filled up by an alluvial soil, so that it appears the mountains formerly constituted islands and the valleys straits. On the mainland itself, the highest portion of the elevated region lies near the inner extremities of the inlets, whence it extends on the whole as a plain, which insensibly grows lower as it proceeds southward. The surface of the plain is only interrupted by flat and wide depressions in the form of valleys, and single hills rising from 300 to 500 feet above it. On the north the plain is in general from 2500 to 3000 feet above the sea, but towards the south and east it sinks to 1500 feet. No trees are found on it except birch and mountain-ash, which do not attain their full height. This plain is visited in summer by the Laplanders, as it produces excellent pasture for their rein-deer.

Permanent settlements are only found in the recesses of the fiords. On the other fiords the scanty population consists of persons who derive their subsistence from fishing; but on the Alten-elf there is a considerable number of agriculturists, who cultivate barley and potatoes, this being the most northern point of the globe where cultivation is carried on with success. There are numerous cattle, and the Finlanders, called Quäns in this part, have dairies. There are also some copper-mines, which are worked by an English company. As firewood is not abundant, the ore is shipped to Swansea in South Wales, and there smelted. Thus the shores of the Altenfiord are more populous than any part of Trondhiem north of Cape Kunnen.

The lower region is in general a plain, which in its highest point, near the sources of the Alten-elf, is about 1200 feet high, but gradually decreases in height as it proceeds north and north-east. On this plain a few isolated mountains rise to a height of between 3000 and 4000 feet. From the last mountain a lower chain extends between the Laxafiord and Tanafiord, which terminates north of 71° N. lat. with Cape Nordkyn, the most northern promontory of the European continent. The surface of the plain is interspersed with innumerable smaller and larger lakes, and is mostly covered with rein-deer moss. It is therefore used by the Laplanders as winter pasture. The more elevated parts of the plain are overgrown with stunted birch. On this plain rises the Alten-elf. Between Kautokeino and Maasi its course is slow, but at the last-named place it enters the mountains, where it dashes over perpendicular falls, until the valley through which it runs becomes a mere fissure enclosed by precipitous rocks. No person has yet followed its course into the straits, through which it makes its way at the cataract of Pursoronka, about 15 miles above Altengaard. The Tana-elf, which is much larger, running about 150 miles, is less rapid, and might be navigated, if the inhabitants of the country through which it flows had any occasion for it. An immense quantity of salmon is annually taken in this river, which are considered the finest in all Norway.

Several large islands lie along the coast of Finmarken, west of the Porsanger fiord. The largest of them, Seyland and Soröe, rise to a great elevation, and are inhabited by a few fishermen. On Qualöe is a commercial place, Hammerfest, which has about 400 inhabitants. The harbour, being safe, is much visited by foreign vessels, especially Russian and English. In 1823 not less than 177 vessels entered it. The Russian vessels from Kola and other places come to fish or to buy fish, and bring hemp, flax and tow, sailcloth, linen, tar, nails and ironmongery, and sometimes considerable quantities of corn. Hammerfest is also the station for many vessels which are employed in the whale fishery about Cherie islands and along the southern coast of Spitzbergen. The most northern island is Mageroë, a bare rock, which towards the north terminates in the North Cape, a huge mass of rocks rising to 1500 feet above the sea. At the eastern extremity of Finmarken is the small island of Wardoë, on which is the small fortress of Wardoëhuus, with about 100 inhabitants.

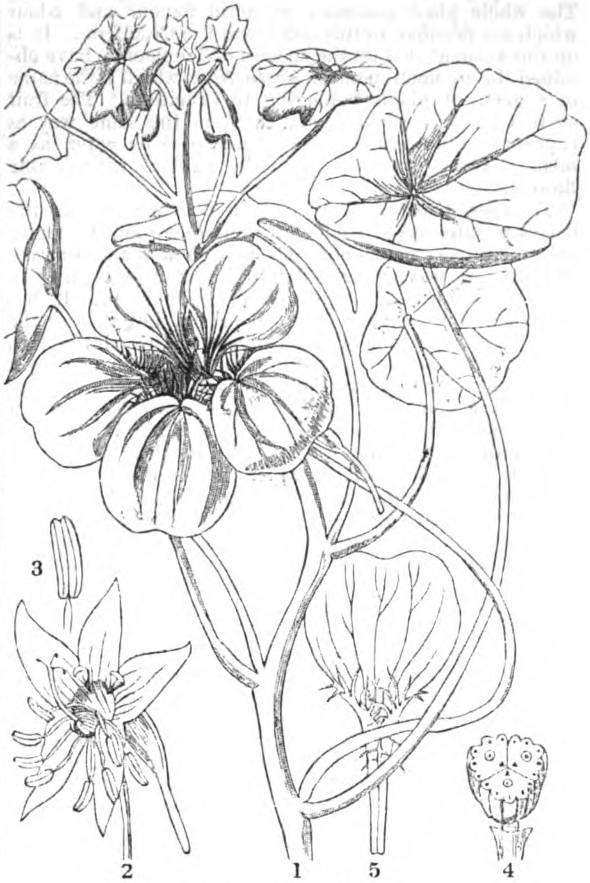
Particulars on the climate of Trondhiem are found in NORWAY, vol. xvi., pp. 325 and 326.

(Von Buch's *Reisen durch Norwegen und Schweden;* Everest's *Journey through Norway, Lapland, and part of Sweden;* Breton's *Scandinavian Sketches;* Barrow's *Excursions in the North of Europe;* Barrow's *Visit to Iceland by way of Tronyem;* Laing's *Journal of a Residence in Norway;* Linblom's 'Besuch in Romsdalen,' in Berghaus's *Almanach*, 1841.)

TRONDHIEM, the capital of the province of the same name, is built on the southern shore of Trondhiem Fiord, at the mouth of the Nid-elf, which river nearly encircles it. It has regular and wide streets, with water-cisterns at their intersections. The houses are generally of two stories, and built of wood, hardly half a dozen of them being of brick. The cathedral is a Gothic building, a part of which was erected as far back as 1033. In the fiord, and at a distance of about a mile, is a small rocky island, Munkholm, on which a fortress is built. The roadstead for shipping is exposed to a heavy swell from the north and north-west, and has a loose ground in 20 fathoms. The population consists of between 12,000 and 13,000 individuals. There is a society of arts, a grammar-school, an establishment for the education of young Laplanders, and some elementary schools. There are also an hospital for aged and infirm, a workhouse, a public library, and a museum. The commerce is considerable. The exports consist of fish (dry salmon, ling, cod, and herring), fish-oil, timber, tar, copper brought from Röraas, and millstones. The town employs about 60 ships, and 260 yachts, or coasting small craft, in the fisheries along the northern coast of Norway, and about 50 vessels in conveying wood and timber to France. A few cargoes go to Ireland and Scotland. Besides these, 154 were bound outward in 1830,—namely, 56 to Great Britain, 28 to the Mediterranean, 28 to Spain, 17 to Denmark, 12 to Holland, and the rest to Hamburg, Bremen, and some parts of the Baltic.

(Barrow's *Visit to Iceland by the Way of Tronyem;* Laing's *Journal of a Residence in Norway.*)

TROPÆO'LEÆ, a small suborder of plants in the natural system of Lindley, in the natural order Balsaminaceæ. Jussieu makes it a distinct order. The plants belonging to this order are smooth, tender, and herbaceous, with diffuse or twining stems, and alternate, petiolate, peltate leaves; the flowers are irregular, axillary, and solitary; the calyx has five sepals, the upper one with a long distinct spur; the petals are unequal and irregular, the two upper are sessile and remote, arising from the throat of the calyx, the three lower stalked, and smaller, sometimes abortive; the stamens, eight in number, perigynous, the filaments distinct; the anthers minute, erect, 2-celled, dehiscing longitudinally; ovary consisting of three carpels; style one, stigmas three, acute; ovules solitary, pendulous; the fruit is indehiscent, separating into three pieces which surround a common axis; the seeds are large, having no albumen, and filled with the embryo, the cotyledons of which are thick and consolidated together into a single body; the radicle lies within the projections of the cotyledons.



Tropæolum majus.

1, Branch, showing peltate leaves; 2, Flower with calyx, spur, and petals; 3, Anther; 4, Tricapsular fruit with single seeds; 5, petal removed.

The species of this order differ from Balsaminaceæ in their more regular flowers, and in the juicy fruit not having a bony lining to the cells. They resemble Geraniaceæ in the possession of a spur. The genera belonging to this suborder are Tropæolum, Magallana, and Chymocarpus, and all of them natives of South America.

The properties of this order are very similar to those of Cruciferæ, although there is little structural resemblance. [TROPÆOLUM.]

TROPÆ'OLUM (from τρόπαιον), a genus of plants, the type of the suborder Tropæoleæ. It has a 5-parted calyx, the upper lobe being furnished with a spur; 5 petals, unequal, the three lower ones smallest or altogether absent; 8 stamens, free from the base; 3 carpels, somewhat erose, kidney-shaped, indehiscent, furrowed, roundish; the seed large, filling the cell. The species of this genus, which derives its name from the petiole being inserted into the centre of the leaf, giving it the form of a buckler, are all of them inhabitants of South America. De Candolle enumerates 13 species, Don 18, and two others have been lately added to their number. They are all climbing plants.

T. minus, Small Indian Cress or Nasturtium, has peltate-nerved orbicular leaves, the nerves mucronate at the apex; the petals each ending in a bristle-like point. This plant is a native of Peru. It is one of the species of the genus that was earliest brought to Europe, and was cultivated in England by Gerarde. It has however now been nearly supplanted in cultivation by the next species. It has deep yellow flowers streaked with orange and red. The whole plant possesses an acrid flavour and odour which are peculiar to this order and the Cruciferæ. It is on this account that all the species of Tropæolum have obtained the common name of *Nasturtium*, which is the name of a genus of plants belonging to Cruciferæ. The fruit of this plant is pickled, and eaten in the same way as capers; the flowers and leaves may also be eaten as a salad. There is a variety in the gardens with double flowers.

T. majus, Great Indian Cress or Nasturtium, has the leaves peltate-nerved, orbicular, somewhat 5-lobed; nerves not mucronate; petals obtuse. This plant is also a native of Peru. It was introduced into England, according to Peter Collinson, says Smith, in the year 1686. It has much larger flowers than the preceding, but having the same colour and general appearance. The fruit of this, when green, like the preceding species, is made into a pickle, for which its warm biting character renders it very fit. It is a plant that easily propagates itself by its own seeds, and is at this time almost naturalized in many of our gardens. Of this species, like the last, there is a beautiful double variety, which is deservedly a great favourite in our gardens and greenhouses. There is a species between this and the last, known in gardens as *T. hybridum*. It was first observed in the garden at Stockholm, and described by Linnæus. Its flowers are yellow, but never mature their seeds, consequently it is only propagated by cuttings.

T. aduncum, Hooked Indian Cress or Nasturtium, has peltate-nerved leaves somewhat kidney-shaped, with from 5 to 7 lobes, which are mucronate; the two upper petals lobed, mucronate, the three lower ones smaller, fringed; the spur hooked, and about the length of the upper petals. It is a native of both Mexico and Peru. It is a very tender plant, requiring greenhouse cultivation in this country.

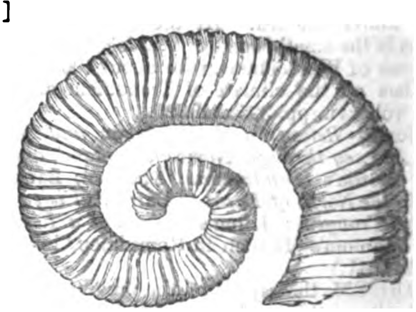
T. tricolorum, the Tricolor Indian Cress or Nasturtium, has a tuberous root; a slender, climbing, branched stem; leaves peltately divided with 6 or 7 obovate entire and cuspidate segments; cirrhose petioles, unguiculate petals, a little longer than the rather closed, obtuse, quite entire, permanent calyx. This plant is a native of Chili at Coquimbo. It has a calyx of an orange-scarlet colour, and tipped with black, whilst the petals are yellow. It is the most showy and handsome of the species. The *T. tuberosum*, like this species, has tuberous roots which are eaten when boiled. It is a native of Peru.

T. pentaphyllum, the Five-leaved Indian Cress or Nasturtium, has 5 leaflets which are ovate or ovato-lanceolate, entire and stalked; only 2 petals, which are sessile, acute, quite entire, shorter than the calyx. This plant has tuberous roots, yellow petals, and a greenish yellow calyx. It is a native of Buenos Ayres, Monte Video, and Brazil in the province of Cisplatine. This plant was known in Europe for a long time only by Lamarck's description. It has however been lately cultivated in Great Britain, and an examination of the plant has induced D. Don to constitute it a new genus. The reasons he assigns for this are its fleshy juicy fruit and its valvate æstivation, in both of which points it differs from the genus Tropæolum. He calls it *Chymocarpus pentaphyllus.*

T. azureum, Purple Indian Cress or Nasturtium, has the leaves 5-parted, with linear unequal laciniæ; equal, entire, bilobed petals much longer than the calyx, with a spur shorter than the petals. This plant was discovered by Mr. Miers, and first described in his 'Travels in Chili,' and had been previously seen by Mr. Bridges on the Carycam de Quillota, 4000 feet above the surface of the sea. The plant was not however seen in blossom in this country till October, 1842, when its successful cultivator obtained for it a silver medal from the Horticultural Society of London. In the figures and descriptions of this plant published by Dr. Lindley and Sir William Hooker in the parts of the 'Botanical Register' and 'Botanical Magazine' for December, 1842, in the one the plant possesses entire petals, whilst in the other it is made to possess serrated petals. Dr. Lindley observes with regard to this interesting plant, that 'A few years since a blue nasturtium was placed in the same class as a hippogriff or a unicorn, for men's minds were warped by theories of cyanic and xanthic series in flowers, which it was said could not interfere with each other. It was asserted that in those cases where a pure yellow is observable in a particular genus, no blue could possibly be produced; and that, on the contrary, where a blue colour exists in a genus, yellow was expelled. It is true that the hyacinth and aconite seemed to offer some difficulty in the way of these propositions, but it was alleged that the so-called yellow of the hyacinth was a bad green, and that the blue of the aconite was really violet. However, here is a genus in which all the species previously discovered were either yellow or some colour in which yellow occurs in manifest combination; but the *T. azureum* has no yellow at all, its blue being as perfect as that of the Siberian larkspur.' From this we may anticipate that other blue flowers will be found amongst the red and yellow series, and that reds or yellows may be found amongst the blues.

Most of the other species of Tropæolum have obtained a place in our collections, on account of their handsome and variously coloured flowers. The greenhouse species will thrive in a light rich soil. For the *T. azureum* a mixture of sandy loam with leaf-mould and fibry peat, not sifted, is best. It will bear the open air in summer. When exposed to the open air, many of the species are annual, which would, if protected, be perennial. They may be either propagated by seeds or cuttings. They are all climbing plants when placed near anything to support them: if this is not done, they become prostrate. When grown in pots, they may be allowed to droop over their sides, a mode of growth which seems to suit many of them very well.

TROPÆUM, Mr. Sowerby's name for a genus of *Ammonites* [CORNU AMMONIS] apparently identical with *Crioceratites*, and consisting of those species which have their whorls disconnected, such as *Crioceratites Duvallii.* [TURRILITES.]



Crioceratites Duvallii.

TROPHIS, a small genus of plants of the natural family of Artocarpeæ, so named from τρέφω, 'to nourish,' though the species are not very remarkable in this respect. The species are found both in the East and West Indies, though it is supposed by some that these may be generically distinct. The flowers are diœcious; spike lax, axillary; male, perigone 3-leaved, spreading, stamens four; female, perigone 3-leaved; ovary ovate, one-celled, one-seeded; stigma bifid. The species form milky trees with alternate entire leaves. T. americana, the Ramoon-tree, is twenty feet high, and a native of the West India Islands, where the leaves and twigs make a wholesome fodder for cattle in the inland woody parts of Jamaica. The drupes are about the size of grapes, and have a pleasant flavour.

T. aspera is a native of and common in all parts of India, sometimes shrubby, but it also grows into a small crooked tree. Its leaves are oblong, unequally serrate, and so scabrous, as to be employed by the natives in polishing ivory. The berries are greedily eaten by birds. T. spinosa is another Indian species, less common: thorny; leaves oblong lanceolate, towards the apex grossly serrate, smooth; female calyx twice the length of the ovary, and eaten by the natives in their curries.

TROPHY (τρόπαιον, *tropaeum*) contains the same root as the Greek verb τρέπειν, 'to turn or to put to flight,' and was therefore originally a sign or memorial erected on the spot where an enemy had been conquered or put to flight. The custom of erecting such memorials of victories either on the field of battle or in the capital of the conquering nation has been more or less common to all nations from the most remote to the most modern times. It was most general among the Greeks, who used to erect trophies even after slight advantages; and it sometimes happened that both the belligerent parties, owing to some advantages they had gained, considered themselves entitled to erect trophies. It was further a practice among the Greeks seldom to erect trophies in any other place than the field of battle, and that immediately after the victory was gained: when an enemy had been conquered at sea, the trophy was erected on the point of the coast nearest to the place where the victory was gained. A trophy in Greece after a victory on land appears to have consisted of a trunk of a tree fixed on some eminence and adorned with the spoils and armour of the vanquished. An inscription usually recorded the names of the conqueror and the conquered, and the whole trophy was dedicated to some divinity. It was customary not to make trophies of very durable materials, in order not to perpetuate the disgrace of a defeated enemy or to keep up any ill-feeling for too long a period. But this was not always observed. After a naval victory the trophy was usually adorned with the beaks of the captured ships of the enemy, and this custom was adopted by the Romans at an early period. The Romans down to the latter period of the republic never erected any trophies on the field of battle: the spoils of a vanquished enemy were partly distributed among the soldiers, partly dedicated in the temples of the gods, and partly applied as ornaments for other public buildings and places. When however the Romans adopted the custom of raising trophies on the field of battle, they usually consisted of more solid structures than the Greek, such as towers, columns, &c.

(*Dictionary of Greek and Roman Antiquit.*, p. 1010, &c.)

TROPIC BIRD, *Phaëton*, Linn., a genus of palmipede birds, placed by some ornithologists among the PELECANIDÆ, and by others among the LARIDÆ.

This genus, so well known to navigators as the harbinger of the tropics, is distinguished at once by the two long slender tail-feathers, which have obtained for the species, of which two only are recorded, the French name of *Paille-en-queue*. Their length of wing and comparatively feeble feet proclaim them formed for flight, and they are accordingly swift and untired on the wing, disporting in the air far at sea; and when on land (to which they do not often retreat for any length of time together, excepting at the period of nidification), perching on rocks and trees. They rarely quit the torrid zone and its neighbourhood.

M. Lesson remarks that the two species form a well-defined artificial and purely geographical group. Their habitual domicile in the torrid zone does not separate them from the land; and they can reach, as they do nearly every night, the isles and lofty rocks that serve them as a place of refuge. Nevertheless M. Lesson met with them so often in sea-tracts entirely devoid of land, and heard them so often above his head in the calms and fine tropical nights, that he thinks they should be considered as oceanic birds.

The same author remarks that sudden squalls or hurricanes, so frequent in the equatorial zone, often sweep these birds beyond their natural limits; and he thus accounts for seeing them, as he many times did, in 30° S. lat.

The common tropic-bird, *Phaëton æthereus*, he says, 'semble être confiné dans l'océan Atlantique et s'arrêter dans les mers de l'Inde.' The other species, *Phaëton phœnicurus*, he remarks, appears to belong more particularly to the great equinoctial ocean. Nevertheless, he adds that both species exist in nearly equal numbers at the Isles of France and Bourbon. He describes the flight of these birds as calm, quiet, and composed of frequent strokes of the wing, sometimes interrupted by a sort of falls or sudden movements.

Mr. Swainson, speaking of the Frigate Pelicans (*Tachypetes*), observes that their history no less than their whole structure is highly interesting. They are, he remarks, truly rapacious birds, endowed with a remarkably piercing sight, with an immense expanse and power of wing, and with the most determined audacity, attacking other birds nearly of their own size, and forcing them to disgorge or relinquish the fish they may have caught. 'We know not,' says Mr. Swainson, 'a more imposing sight than half a dozen of these aërial birds soaring in mid-air, and suddenly falling down into the sea upon a shoal of fish that have approached too near the surface. At other times, during a storm, they soar to such a height, that, notwithstanding their size, they appear but as specks in the firmament: all their powers of motion, in fact, are concentrated in the wings; for the feet are so short and imbecile, that when upon the ground they may be approached with perfect ease. These birds, although common in the tropical seas, are not found beyond, and are thought to belong to but one species. The same regions, as their name implies, are inhabited by the tropic-birds (*Phaëton*), whose flight, although inferior, is frequently as high as that of the Frigate-bird: there are but two species, both having two of the tail-feathers very long.' (*Classification of Birds.*)

Mr. G. R. Gray makes the *Phaëtoninæ*, consisting of the genus *Phaëton* only, the second subfamily of his *Pelecanidæ*, placing it between the *Plotinæ* and the *Pelecaninæ*. (*List of the Genera of Birds*, 1841.)

Phaëton, Linn. (*Lepturus*, Mæhr; *Tropicoliphus*, Leach.)

Generic Character.—Bill strong, stout, hard, trenchant, compressed, convex above, dentilated on its edges, inclined towards the end, pointed; nostrils linear, covered by a naked membrane; face feathered; feet very short; wings long; first quill the longest; tail short, excepting two very long slender tail-feathers.

M. Lesson observes that the two species which compose this genus are destined to live within the twenty-five degrees of latitude next to the equator, either to the north or south. It is only, indeed, accidentally that they are seen beyond the tropics of Cancer and Capricorn, and consequently their presence has always been considered by mariners as indicating that their ships were entering the equatorial zone, whence the name of *Phaëton*, son of Sol, given to these birds by the poetical imagination of Linnæus.

The same zoologist, who had good opportunities of personally observing these birds, says that nothing can be more graceful than their flight. They glide along, most frequently without any motion of the wing, on the sustaining air, but at times this smooth progression is interrupted by sudden jerks (saccades). When they perceive a ship, they never fail to sail round it, as if to reconnoitre. They ordinarily return every evening to the land, to roost in the midst of the rocks where they place their nests. Their food appears to consist entirely of fish. The long feathers of the tail are employed by the natives of the greater part of the South Sea Islands as ornaments of dress.

Example, *Phaëton æthereus*, Linn., 'The Tropic Bird' of Catesby, Sloane, and others. The following is Catesby's description:—

'This bird is about the size of a partridge, and has very long wings: the bill is red, with an angle under the lower mandible, like those of the gull kind, of which it is a species: the eyes are encompassed with black, which ends in a point towards the back of the head: three or four of the larger quill-feathers towards their ends are black tipped with white: all the rest of the bird is white, except the back, which is variegated with curved lines of black: the legs and feet are of a vermilion red: the toes are webbed: the tail consists of two long straight narrow feathers almost of equal breadth from their quills to their points.'

'These birds,' says the same author, 'are rarely seen but between the tropics, at the remotest distance from land. Their name seems to imply the limits of their abode; and though they are seldom seen but a few degrees north or south of either tropic, yet one of their breeding-places is almost nine degrees from the northern tropic, viz. at Bermudas; where, from the high rocks that environ those islands, I have shot them at the time of their breeding: but those cliffs being inaccessible prevented my seeing their nests and eggs. They breed also in great numbers on some little islands at the east end of Porto Rico' (*Carolina*).

Sir Hans Sloane, in his 'Voyage to Jamaica,' says: 'The 5th of November we saw the Tropic-bird, or *Avis Tropicorum*, flying very high round the ship; they are very easily known by two long feathers in their tails; to me it seems to be rather of the gull than duck kind. They are common everywhere between the tropics, and rarely seen anywhere else, whence they have their name.

'They are ordinarily met with first in the voyage to the West Indies three hundred leagues off Dominica, or Desada, towards Spain; though in the third voyage we made thither we met with one in the midway between Spain and the Canaries, which every one wondered to see so near Spain. (Oviedo.) I suppose this accident might have happened when the sun was north of the equinoctial and towards the tropic of Cancer.'

'The feathers in the tail are made use of as ornamental by the savages in their hair and nostrils.' (Du Tertre.)

Browne (*Jamaica*) states that this species lives, like the man-of-war bird, within the tropics, and resembles it very much in make, flight, and manner of nourishment; but that it is seldom seen so near the shore. It breeds, he adds, on the most desolate rocks and lonely islands, and is often seen at very considerable distances from land.

There was a specimen in Tradescant's museum.

Phaëton Ætherens.

The following is the description given by M. Lesson of the other species, *Phaëton phœnicurus*:—

Length from the extremity of the bill to the origin of the tail, thirteen inches, six lines; of the bill from the point to the commissure, three inches, eight lines; breadth across the expanded wings, thirty-one inches. Length of the tail, five inches; of one lengthened tail-feather (*brin*) taken at the extremity of the tail, seven inches, six lines; of the second and smaller long tail-feather (*brin*) taken from its origin, six inches. Ten tail-feathers, without counting the long one, which, at its origin, is enlarged like the other feathers: the tail forms a fan. Feet, taken from the leg to the toes, three inches. Legs white, with a light bluish tint in some places; webs partly black, that between the hind toe pale flesh-colour slightly glazed with white. Bill red, denticulated; nostrils near the origin of the bill, rather large, presenting forwards a canal which scarcely extends to the middle of its length, and of a blackish tint. Plumage satin-white: in front of the eyes a large brown spot. The anal feathers present a great black spot in their centre, as well as some of the feathers which approach the body. The long tail-feathers (*brins*) are red, the smallest being of the deepest hue. The shafts of the greater quill-feathers, of the tail-feathers, and the long tail-feathers (*brins*) are black, but towards the extremity they are white. (*Manuel.*)

TROPICS (τροπή, *a turning*), the circles of the earth parallel to the equator which pass through those places to which the sun is vertical at the solstices, being the extreme boundaries of the torrid zone. The latitude of any spot upon either tropic is therefore the same as the obliquity of the ecliptic, and the interval between the northern and southern tropics comprehends every part of the earth at which the sun is ever vertical. The northern tropic is called the tropic of Cancer, and the southern that of Capricorn, since the sun, when vertical at places in the first, is at the commencement of the astronomical sign of Cancer; and when vertical at places in the second, is at the commencement of Capricornus.

TROPIDOGASTER, the name given by MM. Duméril and Bibron to a genus of Saurians (*Eunotes*), belonging to the Iguanian lizards.

Generic Character.—Head short, triangular, obtuse in front. Susocular regions covered with a great number of polygonal scales, much smaller than the other cephalic scales, and carinated, like them. A moderate occipital scutellation. Nostrils lateral, tubular. No palatine teeth. Throat with two or three entire transverse folds. One or two longitudinal folds on the sides of the neck. Tympanic membrane a little sunk. Anterior border of the ear subdenticulated. Trunk very slightly depressed; a fold of the skin along each flank. Scales of the back small, unicarinated, and with convex edges; those of the belly with three carinations. A small dentilated crest, from the occiput to the end of the tail, which is long, subconical, very slightly depressed at its base, and surrounded with verticillations of carinated scales. Toes and claws slender. No femoral pores. (Dum. and Bibr.)

MM. Duméril and Bibron observe that three principal characters establish the differences between this genus and *Callisaura*. These are—the femoral pores, the want of a longitudinal fold under the throat, and the presence of a small dentilated crest from the nape to the caudal extremity. Moreover, the susocular regions are furnished with a great number of scales, one-half smaller than the plates of the other parts of the head, the small scales of the upper region of the trunk are unicarinated, those of the lower region tricarinated, and the border of the ear is subdenticulated; finally, the longitudinal cutaneous body-fold from the axilla to the groin is less developed than in *Callisaura*. For the rest, the genus *Tropidogaster* nearly resembles *Callisaura*, but it has the trunk and tail rather less depressed, and the nostrils more distinctly tubular (*Erpétologie.*)

Only one species is known, *Tropidogaster Blainvillii*. Locality unknown.

TROPIDO'LEPIS, Cuvier's name for a genus of Saurians resembling the *Agamæ* in their teeth and form, but uniformly covered with imbricated and carinated scales. Their series of pores is very strongly marked.

Example, *Tropidolepis undulata* (*Agama undulata*, Daudin), an American species, remarkable for the white cross which it has under the throat on a dark-blue ground.

MM. Duméril and Bibron, who place *Lepidolepis*, Cuv. (*Sceloporus*, Wiegm.; *Tropidurus*, in part Wagl.), among the *Iguanian Lizards* or *Eunote Saurians*, thus characterize the genus:—

Head short, flat, rounded in front. A great occipital scale; great susocular plates. No palatine teeth. Below the neck smooth; on each side a kind of oblique slit. Trunk short, depressed, with an imbricated scaling, carinated on the back, smooth under the belly. Neither dorsal nor caudal crest. Tail stout, but little elongated, depressed at its base, afterwards rounded. Femoral pores: no anal pores.

MM. Duméril and Bibron observe that this genus, which, when Cuvier wrote, comprised but a single species, *Agama undulata*, Daud., now comprehends nine others, all natives of Mexico.

TROPIDOLOPI'SMA, a name given by MM. Duméril and Bibron to a genus of *Scincoidian Lizards*, belonging to the division *Saurophthalms*. [SCINCOIDIANS.]

Generic Character.—Nostrils opening in the middle of the nasal plate; no supero-nasal plate. Palate without teeth, with a very deep, triangular, pointed notch. Scales carinated.

Example, *Tropidolopisma Dumerilii* (*Scincus aterrimus*, Péron; *Tiliqua Kingii* and *Tiliqua Napoleonis*, Gray. Four varieties, one entirely black. (See Dum. and Bibr., *Erpétologie*, vol. v.)

Locality.—New Holland.

TROPIDO'PHORUS. [Scincoidians, vol. xxi., p. 74.]

TROPIDORHYNCHUS, the name given by Mr. Vigors and Dr. Horsfield to a genus of Meliphagidæ.

N.B. The following is Mr. G. R. Gray's arrangement of the *Meliphagidæ* :—

Subfam. 1. Myzomelinæ.

Genera: *Myzomela*, Vig. and Horsf.; *Acanthorhynchus*, Gould; *Glyciphila*, Sw.

Subfam. 2. Meliphaginæ.

Genera: *Meliornis*, G. R. Gray; *Prosthemadera*, G. R. Gray; *Ptilotis*, Sw.; *Anthornis*, G. R. Gray; *Philemon*, Vieill.; *Phyllornis*, Boie; *Meliphaga*, Lewin; *Anthochæra*, Vig. and Horsf.; *Acanthogenys*, Gould; *Entomyza*, Sw.; *Tropidorhynchus*, Vig. and Horsf.

Subfam. 3. Melithreptinæ.

Genera: *Plectoramphus*, G. R. Gray; *Manorhina*, Vieill.; *Psophodes*, Vig. and Horsf.; *Eidopsarus*, Sw.; *Melithreptus*, Vieill.; *Entomophila*, Gould.

Mr. G. R. Gray makes this family the fourth of the *Tenuirostres*, and places it between *Trochilidæ* and *Certhidæ*.

TROPIDOSAURA, Boie's name for a genus of *Lacertian Lizards*, or *Autosaurs*, belonging to the subfamily of *Cælodont Autosaurs* (*Leiodactyls*) of Duméril and Bibron (*Algira*, Cuv.; *Psammuros*, Wagl.; *Psammurus*, Wiegm.).

Generic Character.—Tongue not sheathing itself at the base, moderately long, notched at its free extremity, with squamiform, imbricated papillæ. Palate toothed or not. Intermaxillary teeth simple, conical. Maxillary teeth slightly compressed; the first simple, the succeeding ones tricuspidate. Each of the nostrils opening in a single plate, the naso-frenal, situated under the summit of the rostral canthus. Eyelids. Membrane of the tympanum distinct, stretched within the auricular opening. No squamous collar under the neck, but a small fold of the skin before each shoulder. Scaling of the throat, breast, and belly composed of small, delicate, smooth laminæ, with a round or sub-rounded border, and imbricated femoral pores. Each of the feet with five slightly compressed toes. Tail cyclotetragonal. (Dum. and Bibr.)

MM. Duméril and Bibron state that the *Tropidosauræ*, form a small but very natural genus, easily to be distinguished from the others which, with it, compose the group of *Cælodont Leiodactyls*. On one side, the *Tropidosauræ*, by their squamous tongue, their femoral pores, and the entire absence of a collar, differ from the *Tachydromi*, whose tongue has chevron-shaped folds, which have only inguinal pores, and a collar of scales in front of the breast. On the other side, this same absence of collar, joined to the rounded form behind, and the imbricated condition of their ventral scales, prevents them from being confounded with the numerous genus of Lizards properly so called, in which there always exists across the lower region of the neck a row of large scales, and, on the belly, quadrilateral plates more or less developed, disposed in a quincunx.

MM. Duméril and Bibron remark that the *Tropidosauræ* lean in their general form both towards the lizards and scinks: like the last they have the body narrow and rounded in appearance; they have no collar under the neck, and the whole scaling of their lower region offers the greatest resemblance to that of fishes of the carp kind; but on observing their head, it is seen to be protected by squamous pieces, differing but little in number, form, and disposition from those of the cephalic shield of the lizards properly so called, many of which the *Tropidosauræ* equally resemble in their dorsal scales.

The head of the Tropidosaurs has the form of a four-faced pyramid; their belly is flat, their back slightly arched across, and their sides or flanks are perpendicular, slightly arched outwards. Sometimes the limbs are developed in proportion to the other parts of the body; sometimes, on the contrary, they are extremely short. The tail is comparatively much less extended than that of *Tachydromus*. On the anterior extremities the first finger or the thumb is very small; the second is once, and the third and fourth are twice as long again; the fifth is shorter than the second. The four first posterior toes are regularly graduated; and the last, attached very backward upon the tarsus, is a little longer than the second. The tongue, moderately elongated, narrowed, and divided into two flattened points at its free extremity, presents behind two other points separated so as to form a V, between which the glottis is situated: its surface is furnished with squamiform papillæ, except on its edges and the posterior part, where may be seen transverse slightly angular folds.

The palate is, in general, armed with some small teeth to the right and left of its notch. There are ten conical, simple intermaxillary teeth; twenty-five upper, and an equal number of lower maxillary teeth on each side. The maxillary teeth are straight, a little compressed, with an obtuse summit, and divided into two or three blunt points.

The upper eyebrow is very short, and the lower, on the contrary, very high; but both are paved, as it were, with small, angular, thick, and flat scales.

The plates that cover the upper part of the head are the same in number, and disposed in the same manner as in Tachydromus. Sometimes the naso-frenal plate is simple, sometimes it is divided in its middle in the longitudinal direction of the head: there is always a first and second post-naso-frenal. One of the upper labial plates, that which is placed immediately below the eye, is a little extended in length, and ascends to the orbital border. Some quadrilateral plates are applied against the upper margin of the temple, which is furnished with rhomboidal or hexagonal inequilateral carinated scales, which are sometimes intermingled with scales of different sizes.

The skin of the lower part of the neck is perfectly tense, and the scales which cover it are equal and very regularly disposed, but there is a small cutaneous fold in front of each shoulder.

Rhomboidal, carinated, imbricated scales, pointed backwards, and very large when compared with those of the ordinary lizards, cover the whole of the upper part of the body, the limbs, and the tail. They compose an upper scaling entirely resembling that of the tropidolepids and the proctotretes [Tropidurus], genera of the family of Iguanians, a scaling which is equally shown in some species of lizards properly so called, as well as in the genus *Psammodromus*.

The *Tropidosauræ* are remarkable as being nearly the only Lacertians whose lower parts, that is to say, the throat, the neck, the breast, the belly, and the under part of the limbs, are protected by scales absolutely resembling those which clothe the same regions in the greater part of the species of Scincoidians. Granules extremely close-set cover the posterior surface of the thighs, along the under part of which is a series of pores. The subdigital scutellations are smooth, sometimes rather thick; they form a single row, and are disposed like the tiles on a roof. The claws are moderately long, compressed, arched, and pointed. (*Erpétologie.*)

Four species are recorded, all inhabitants of the Old World:—*Tropidosaura algira*, Fitz. (Mediterranean coasts of Africa); *Tropidosaura capensis*, Dum. and Bibr. (Cape of Good Hope); *Tropidosaura montana*, Boie (Java); and *Tropidosaura Dumérilii*, Smith (South Africa).

TROPIDU'RUS, Wiegmann's name for a genus of Saurians, placed by Mr. Swainson under the *Agamidæ*, by Mr. J. E. Gray under the *Iguanidæ*, and by MM. Duméril and Bibron, who have changed the name, unnecessarily as Mr. Swainson thinks, to *Proctrotretus*, under the Iguanian lizards, or Eunote Saurians.

Generic Character.—Head subpyramido-quadrangular, more or less depressed. Cephalic plates moderate, polygonal; occipital, in general, not very distinct. Palatine teeth. Neck plaited at the sides or entirely level. Tympanic membrane a little sunk. Body rounded or slightly depressed, covered with imbricated scales, the upper ones carinated, the lower smooth. Neither caudal nor dorsal crest. Toes simple. Tail long and conical, or moderate and slightly depressed. No femoral pores. Anal pores in the males. (Dum. and Bibr.)

MM. Duméril and Bibron state that the principal characters which distinguish this genus from *Holotropis* (Dum. and Bibr.; *Tropidurus*, Fitz. in part, *Leiocephalus*, Gray), which immediately precedes it in their arrangement reside in the entire absence of a crest on the upper part of the body, in the non-compression of the tail, and in the existence of pores (in the males) on the free border of the kind of lip which closes the cloaca. The species of the genus under consideration have not, they observe, like the Holotropids, before each shoulder a sort of oblique incision produced by the fold which the skin produces at this part. The neck is entirely rounded and level or smooth, or at most offers some irregular plication on its sides. All have the palate furnished with teeth. The jaw-teeth are short, equal, compressed and trilobated for the most part, only the ten or twelve first being rounded and pointed. All equally want femoral pores. The size of the scales varies according to the species, but in all they are surmounted with a carina, terminating most frequently in a sharp point.

MM. Duméril and Bibron further state that they know none which have the scales of the belly carinated. In some species the form of the head is that of a four-faced pyramid a little elongated; in others it is a little depressed and its horizontal circumference has the figure of a triangle obtuse in front. The cephalic plates are very variable in diameter and form; but they are always angular. There is generally, on each susocular region a curvilinear row greater than the other. The occipital scale is so small, that sometimes it is lost in the midst of the others. The tympanic membrane is slightly sunk; sometimes the anterior border of the ear is strongly dentilated, sometimes only slightly, sometimes not at all. The species with a slender body have it rounded and carry a long and conical tail; those whose trunk is short have it a little compressed, and in those cases the tail is moderate and slightly flattened at the base. The length of the limbs is not considerable, the toes are simple.

MM. Duméril and Bibron divide their genus *Proctotretus* into two groups.

1st. *The Leioderes.*

Species which have the neck smooth or level.

Example, *Tropidurus chilensis, nitidus*, et *olivaceus* (var. B.), Wiegm., Less., et Garn.

Locality, Chile.

2nd. *The Ptygoderes.*

Species with the neck folded on each side: nine in number, and all from Chile.

Example, *Proctotretus cyanogaster*, Dum. and Bibr.

N.B. MM. Duméril and Bibron remark that their genus *Proctotretus* corresponds to the division *Leiolæmus* established by Wiegmann in his genus *Tropidurus.*

TROPPAU, a circle in the margraviate of Moravia, properly Austrian Silesia, is bounded on the north by Prussian Silesia; on the south-east and south by the county of Prerau; on the west by Olmütz, and on the north-west by the Prussian county of Glatz. Its area is 1000 square miles, and the population 230,000. It contains several lordships, and those parts of the principalities of Lichtenstein, Iagersdorff, and Neisse, which were retained by Austria when the remainder of Silesia was ceded to Frederick II. of Prussia. There are many mountains in the circle, among the most remarkable of which are the Altvater, 4200 feet high, the Bischofskappe, 3000 feet, and the Hungerberg, with a splendid waterfall. There is only a small portion of low and level ground; the climate however is temperate. The principal rivers are the Oder, the Oppa, and the Mora. Agriculture is very limited: the chief products are oats and potatoes, and flax is the staple of the country. The breeding of horned cattle is neglected, but more attention is paid to that of horses and sheep. The country produces iron, marble, slate, lime, and turf. Most of the mountains are clothed with forests, yet wood is dear. The inhabitants, who in the northern parts of the circle are Germans, and in the south Slavonians, are an industrious race, who very carefully cultivate their ungrateful soil. There are also various manufactures, especially of linen and woollen cloth, some tanneries, and paper-mills.

The principality of Troppau, which forms the southern part of the circle, lies between the Oppa, the Oder, and Mora. On the death of Casimir, duke of Teschen, in 1528, it fell to the crown of Bohemia, and was mortgaged in 1614 by the emperor Mathias to the princely house of Lichtenstein, to which it was formally ceded in full property in 1772. The part situated on the left bank of the Oppa was indeed ceded to Prussia by the treaty of Breslau, but still remains the property of the prince of Lichtenstein. The Austrian portion has about 80,000, and the Prussian 55,000 inhabitants.

TROPPAU, the capital of the principality and of the circle, is situated in 49° 56′ N. lat. and 17° 53′ E. long. It stands in a plain, on the right bank of the Oppa, at its confluence with the Mora, and consists of the town and of three suburbs, containing altogether 11,000 inhabitants, exclusive of the suburb of Katherinendorf, situated on the left bank of the Oppa, which has above 3000 inhabitants. The town has on the whole a cheerful appearance, with straight and pretty broad streets, and some tolerably large and handsome squares. There are several churches, the principal of which are the Gothic church of St. Mary, the church formerly belonging to the Jesuits, and that of the Minorites. Among the public buildings are the theatre, the senate-house, the palace, now converted into public offices, and some others. The gymnasium has a Silesian museum, a good library, and valuable collections of natural history. Troppau is the seat of all the tribunals and public offices of the circle and of the principality, and has a considerable manufacture of linen and woollen cloth, which are the staple articles of its commerce.

Troppau was chosen, in 1820, for the meeting of the Congress which assembled in consequence of the revolutions effected by the standing armies in Spain, Portugal, and Naples, at which the principle of armed intervention was asserted. There were present at this Congress the emperors of Austria and Russia, the king of Prussia, the crown-prince of Prussia, the grand-duke Michael of Russia, and the archduke Rudolph, cardinal-prince-bishop of Olmütz; likewise on the part of Austria, Prince Metternich, the Aulic counsellors Von Gentz, Mercy, and Wacke; on the part of Russia, Count Nesselrode and Count Capo d'Istrias; on the part of Prussia, Prince Hardenberg and Count Bernstorff; the French ministers, De le Ferronayes and Caraman; Lord Stewart, the English ambassador at the Court of Vienna; the Neapolitan Prince Ruffo, Count Golowkin; Prince Wolkonsky; Prince Menzikoff; M. von Alopäus, Prussian minister; General von Krusemark; Count von Zichi; Baron Lebzeltern, and many other diplomatic characters. The chief object of the negotiations was a convention between the great powers not to recognise any constitution which deviated from the legitimate monarchical political system of Europe. England and France appeared however to desire a reconciliation of the differences between Austria and Naples: they both endeavoured to advocate a system of neutrality, the bases of which were laid down in a detailed note by Lord Stewart. Great Britain declared that it would take no part in coercive measures against Naples; and France made its accession to the alliance against Naples dependent upon certain conditions, which were not agreed to by Austria, Russia, and Prussia. The three latter powers united not to recognise the revolution at Naples, and if necessary to use coercive measures against it, reciprocally binding each other to maintain tranquillity in their dominions. Naples endeavoured to justify the state of that kingdom in an official note of the 1st of October, 1820, which was addressed, in the name of the King of the Two Sicilies, to all the courts of Europe; but the sovereigns of Austria, Russia, and Prussia sent a letter to the king of Naples, inviting him to come to Laybach, there to appear as a mediator between his people and the states whose tranquillity was endangered by the Neapolitan revolution, on which, King Ferdinand, with the assent of the Neapolitan parliament, proceeded on the 13th of December from Naples to Laybach, at which place the result of the Congress was finally decided.

(Brockhaus, *Conversations Lexicon*; Stein, *Geog.*; Hassel; Cannabich; *Oesterreichische National Encyklopädie.*)

TROU'BADOURS, the name given to those poets in the Romance language, or Langue d'Oc, who lived in southern France, eastern Spain, and northern Italy, during the twelfth and thirteenth centuries. [ROMANCE LANGUAGE.] The name is a French form, from the Provençal 'trobador,' a derivative of the verb 'trobare,' 'to find,' and means an 'inventor.' The word 'Trouvère,' in northern French, had the same meaning, and served to designate the poets of northern France, or of the Langue d'Oil. The Troubadours were distinct from the Jongleurs: the former were the real poets, and many of them were knights and men of noble birth, who occasionally occupied themselves with poetical composition; whilst the Jongleurs were strolling minstrels, who did not compose poetry, but sang the lays of the troubadours, and accompanied them with their musical instruments, and thence derived their subsistence. Many of the troubadours however were skilled both in music and singing; but those who were not, retained a jongleur in their service. According to the spirit of chivalry, the nobles kept open house for all the wandering followers of war and minstrelsy, and often requited munificently both poets and musicians for their exertions to amuse them.

It was in the south of France that the poetry of the troubadours originated. That fertile region, blessed with a genial climate, had suffered less from the irruptions of the barbarians than the northern provinces of the kingdom, and had retained more of its old Roman civilization: it hardly felt the civil wars of the Merovingian dynasty, and escaped the devastations of the Normans; and during the decline of the Carlovingians it became independent of the French crown by the revival of the kingdom of Bourgogne, or of Arles, and by the power of the great vassals, the counts of Toulouse and of Poitou and the dukes of Aquitaine. At the beginning of the twelfth century the counts of Barcelona acquired by marriage the possession of Provence; and the whole region bordering on the Mediterranean on both sides of the Pyrenees, from the Ebro to the Var, became subject to one dynasty, whilst the people spoke the same, or nearly the same, Romance dialect. It was in the twelfth century that the poetry of the troubadours attained its perfection: that poetry was essentially lyrical and mostly amorous, and was characterised by simplicity, or rather paucity, of ideas, and by a strained refinement of expression, and peculiarity of form, which made it quite distinct from the classical models. In that age and country of chivalry, every noble beauty had in her train some admiring poet; and every poet selected some fair lady—sometimes the daughter, but oftener the wife, of the nobleman to whose retinue he was attached—for the object of his poetical passion and the subject of his song. It was a poetical attachment, although it sometimes ended in a real one: its expression was artificial. These remarks apply generally to troubadour amatory poetry, to which however there are exceptions. The Abbé Andres, in his 'General History of Literature,' passes a severe judgment upon it:—'A few ideas turned and twisted into a thousand forms, and none of these of very happy construction, low and vulgar expressions, a wearisome monotony, and a prolixity as tiresome—a hard and difficult versification, strange and forced rhymes,—these are the general characteristics of Provençal poetry.' Sismondi, in his 'Littérature du Midi de l'Europe,' speaks of it in a more favourable manner.

The troubadours sang also at times of loftier themes. Some of them, who had followed the Crusades and shared the dangers of Eastern campaigns, sang after their return the valiant deeds of the soldiers of the Cross. Others wrote to animate the Christian princes to deliver Palestine from the yoke of the Moslems. Others, especially about the time of the persecution of the Albigenses, wrote bitter satires against the persecutors, the Inquisitors, against the priesthood, the hierarchy, and against Rome itself. That persecution was one of the causes of the decay of troubadour poetry in the thirteenth century. [ALBIGENSES.] Many of the troubadours perished, or fled and died in foreign lands. Afterwards Charles of Anjou, who had become count of Provence by marriage with the heiress of the house of Barcelona, having removed to Naples, took with him many Provençal knights and ladies to grace his new court. There they found a new language, the Sicilian or Italian, which was rising into maturity and was well calculated for poetry, and it became the favourite language of the Anjou court. When, in the following century, Queen Joanna I., being obliged to fly from Naples, returned to Provence, she endeavoured but in vain to revive the study of Provençal poetry; and when, many years later, she adopted Louis, son of King John, and the head of the third house of Anjou, that prince, who thus became possessed of Provence, spoke the Langue d'Oil, or northern French, and had no taste for the Provençal. His grandson René, duke of Anjou, count of Provence and nominal king of Naples, made in the following century some attempts at reviving the poetry of the Langue d'Oc, but the race of the troubadours was now extinct, and the only result of his exertions was the collecting and compiling the lives of the old troubadours by the monks of the isles of Hyères, and after him by Hugues de St. Césaire.

At Toulouse however efforts were made to revive troubadour poetry. The 'Capitouls,' or municipal magistrates of that city, established an academy called 'Del Gai Saber,' or 'of the gay science;' and seven of the best rhymers of the place, styled 'the Seven Troubadours of Toulouse,' were placed at the head of it. They fixed upon the 1st of May for holding an annual public festival, to which they gave the name of 'Floral Games.' The first meeting was held in 1324, and was attended by many poets from various parts of Languedoc. Maistre Arnaud Vidal de Châteauneuf d'Arri obtained the prize, and graduated as doctor of the gay science in consequence of a song in honour of the Virgin. [CLEMENCE ISAURE.] The morality of troubadour poetry underwent a reform under this new institution. It was forbidden by the statutes of the Academy to recite any composition on the subject of unlawful or adulterous love, a frequent theme of the old troubadours. The pageant of the 'floral games' continued to be held till the great French revolution, and we believe it has been revived of late years. But the old language of the troubadours has long since fallen into disuse, and has given way to various patois, the Languedocian, Provençal, Poitevin, and others.

In the fifteenth century Jean Nostradamus, a notary or attorney of Provence, and father of the celebrated physician and astrologer Michel Nostradamus, published 'Lives of the Provençal Poets,' in the compilation of which he exhibited much credulity and want of criticism. In the eighteenth century M. de St. Palaye, an academician and author of the 'Memoirs of Antient Chivalry,' employed much time and indefatigable research in collecting the works of troubadours, which, with his own comments and illustrations, filled about twenty-five folio volumes in MS. From this immense treasury the Abbé Millot extracted his 'Histoire Littéraire des Troubadours,' rather a superficial work. At last Raynouard took the subject in hand, and went through it thoroughly in his 'Choix des Poësies Originales des Troubadours,' 6 vols. 8vo., Paris, 1816-21. In the first volume he has investigated the origin and formation of the 'langue Romane' and its grammar. In the second volume he has given specimens of the general style of the troubadours; he has investigated the existence and the institutions of the Courts of Love; has collected monuments of the langue Romane previous to the age of the troubadours, and has explained the various forms of poetical composition employed by the Provençaux. The third volume contains the amatory poetry of the troubadours; the fourth their military, political, and moral poems. The fifth volume is a biographical dictionary of the troubadours; and the sixth is a kind of supplement to the first, containing philological researches on the connection of the langue Romane with the other languages of modern Europe which are derived from the Latin.

For the various sorts of composition used by the troubadours—their 'Alba,' or morning song; their 'Serena,' their sonnet, a sort of composition which, it is believed, they imparted to the Italians; their 'Planhs,' or songs on the death of a mistress; their 'Sirventes,' which were either satirical, political, or warlike; their 'Tensons,' which were in the form of dialogues—we must refer the reader to Raynouard's work. In romance or narrative poems their literature is very poor; and this is one marked distinction between them and the Trouvères of Northern France, whose poetry was chiefly of the narrative kind. A rhyming chronicle of the war of the Albigenses, written by Guillaume of Tudela, is one of the few narrative poems of the troubadours deserving of mention. The number of didactic poems, philosophical, moral, and religious, is somewhat greater. The fragment of 'The Life of Boethius,' which has been edited by Raynouard, is one of the oldest and most valuable of the moral pieces. The 'Mystery of the Wise and Foolish Virgins' is considered to be the earliest attempt at dramatic composition in any modern language. The 'Breviary of Love,' by Maître Ermengau, consisting of many thousand lines, is important as containing a view of all the learning and knowledge of that age, with scattered notices of other troubadours: there is also the 'Treasure' of Pierre de Corbiac, in about 840 lines, written all upon one rhyme, in which the poet, after giving an account of himself and his estate, makes a display of the extent of his knowledge, Latin grammar, logic, rhetoric, music, arithmetic, geography, astronomy, the indiction, the epact, and all the ecclesiastical calendar, a little medicine, pharmacy, surgery, necromancy, geomancy, magic and divination, mythology, scriptural history, the history, true or fabulous, of several countries, the prophecies of Merlin, the mysterious death of Arthur, and other legends and fables. It is a very curious piece. It does not appear that Maître Pierre had read any classical author; and indeed among the multitude of troubadour compositions there are very few allusions to classical history and antiquities; and those few appear to have been borrowed from monkish chronicles and compilations. Their few Latin quotations are from the Vulgate, or from scholastic sentences. Nor do they seem to have had much intercourse with the Moorish schools of science established in Spain, or to have derived from that quarter any fund of scientific information.

In the fifth volume of his work, as already observed, Raynouard gives an alphabetical catalogue of all the poets who appeared to him worthy of the name of troubadours, with short biographical notices of many of them, from the MSS. of Provençal poetry: they are three hundred and fifty in number. Professor Diez of Bonn, in his 'Leben und Werke der Troubadours,' has collected further information concerning troubadour biography, and has arranged his 'Lives' into regular narratives, placed in chronological order. He begins with William IX., duke of Aquitaine and count of Poitiers, the oldest troubadour on record. He was born A.D. 1071, went with a large force of Crusaders to the East, narrowly escaped with his life, and returned home to indulge in sensual pleasures, and sing of love and also of war and its dangers. But his poems on this last subject are lost. He is thus described by native biographers: 'The count of Poitiers was one of the most agreeable men in the world, and one of the greatest seducers of women, a knight skilled in arms and the affairs of love. He was gifted with poetry and singing, and for a long time travelled about the world that he might betray women.' Anecdotes of him are related by William of Malmesbury. Among other distinguished troubadours there were, Bertran de Born, lord of Hautefort, a restless intriguing man, placed by Dante in his 'Inferno' for having encouraged the rebellion of the sons of Henry II. of England against their father; Arnaud Daniel, likewise mentioned by Dante, as well as Sordello of Mantua; Pierre Vidal, who became mad through love; Jaufré Rudel, lord of Blaya, who, becoming enamoured of the countess of Tripoli solely through reports which he heard from pilgrims of her attractions and goodness, took the cross and sailed for Tripoli, fell ill on board, was landed half dead, and carried to a hostelry, where the countess, hearing his strange story, went to see him, to the great joy of poor Rudel, who thanked God and expired in her arms, and was buried with great solemnity in the church of the Templars; Guillaume of Cabestaing, whose fearfully tragical end was the result of illicit love; Arnaud de Maruelh, called by Petrarch the lesser Arnaldo; Pierre d'Auvergne, who wrote a kind of review of his brother troubadours; Folquet of Marseille and others, an account of whom may be seen in the works above referred to. Tiraboschi, in his 'History of Italian Literature' (vol. iv., b. iii., ch. 2), gives an account of the Italian 'trovatori,' or troubadours, chiefly from a MS. collection of their works in the Este or Modena library, written about the year 1254. Azzo VII. of Este, marquis of Ferrara, was one of their chief patrons. At one time the language and poetry of the troubadours were in fashion in most of the courts of Europe. They were the intermediate step between the old Roman literature and that of the Italian and Spanish languages.

Among the few specimens we have of verses by ladies addressed to their poetical lovers, a little poem of Clara d'Anduse is characterized by much graceful elegance and earnestness of feeling: she tells her lover that she devotes her heart to him, and that if she were now the mistress of her person, he who possesses it should not have obtained it. The countess of Die expresses her unreserved affection for her lover in terms still more explicit.

The singular institution of the Courts of Love is closely connected with troubadour history. Their existence has been denied by some, but Raynouard seems to have established the fact, especially through the evidence of a work in Latin written by Maistre André, chaplain to the court of France about the year 1170, entitled 'De Arte Amatoria et Reprobatione Amoris,' in which there are frequent references to the Courts of Love and their decisions in matters of gallantry, and to a 'Code of Love,' which was compiled we do not know by whom, but was quite in accordance with the decision of the courts. These Courts of Love were wont to assemble in various towns and castles of France; they consisted chiefly of ladies, to whom some knights acted occasionally as assessors. The countess of Champagne is mentioned as having held a court of sixty ladies. The countess of Flanders, Ermengarde viscountess of Narbonne, Eleanor of Guienne, queen of Henry II. of England, had each their Courts of Love, and some of their decisions remain on record. A question having been put to Ermengarde concerning a lady who, being in love with a knight by whom she was beloved, married another, whether she was authorised to repel her former lover, and refuse him her favours—Ermengarde replied, that 'the supervenience of the marriage bond cannot exclude the former love, unless the lady declares she will renounce love altogether and for ever.' Again, a knight was in love with a lady engaged to another: to his entreaties and wailings she said at last that she would listen favourably to his suit, if she should happen to lose her present love. Soon after the lady and her lover married. The other knight now, agreeably to a principle of the Code of Love, reminded the lady of her promise, arguing that she was now married, and had consequently lost her love. The lady refused, saying that she was still in love with and was beloved by her former lover, who was now her husband. Queen Eleanor, being applied to, said: 'We dare not dispute the solemn decision of the countess of Champagne, who declared that "love cannot exist between husband and wife;" we therefore approve that the lady in question should fulfil her promise.'

The Code of Love given by Maître Andre, the origin of which is involved in obscurity, consists of thirty-one articles, and is quite in accordance with the spirit of the above decisions, from which perhaps it was compiled. 'The marriage bond,' says one of the articles, 'is no legitimate obstacle to love with a third party.' Some of the clauses are expressed with a kind of delicacy, and bear evidence of being the work of a female mind, such for instance as these:—'Non est sapidum quod amans ab invita sumit amante. Facilis perceptio contemptibilem reddit amorem, difficilis eum carum facit haberi. Quilibet amantis actus in coamantis cogitatione finitur. Qui non celat amare non potest. Amor raro consuevit durare vulgatus. Amorosus semper est timorosus,' &c. It is easy to trace in the above tenets the principle and practice of the cicisbeism or serventism of Italy and Spain in its more refined form. Petrarch himself was well acquainted with the poetry of the troubadours and its sentiments. That the love of the troubadours was often Platonic through either necessity or the self-respect of one of the parties, is very probable; that it was often not so is abundantly proved by the records of the troubadours themselves, and the revenge of outraged husbands is told in more than one fearful tale. And as Sir Walter Scott remarks, in 'Anne of Geierstein,' vol. ii., the other troubadours who narrate such tragical incidents bestow all their pity on the adulterous lovers, and make no allowance for the provocation given to the injured husband, whom they hold up to execration. This is of a piece with their system of ethics. A strange admixture of pious ideas with those of love is also observable: Guillaume de Cabestaing prays the Virgin Mary to inspire his beloved with tenderness for him: Hughes de la Bacheliere swears by the Holy Gospels that he never begins to recite a paternoster without immediately turning his whole mind and heart towards his lady.

Besides the works quoted in the course of this article, Professor Diez has written also *Die Poesie der Troubadours nach gedruckten und handschriftlichen Werken derselben dargestellt*, Zwickau, 1826; and Raynouard has published *Lexique Roman avec un nouveau Choix des Poésies Originales des Troubadours*, Paris, 1836: we may also notice Mrs. Dobson's *Literary History of the Troubadours*, London, 1807.

TROUT, the common name of various species of fishes belonging to the genus Salmo. In the article SALMONIDÆ the characters of the genus Salmo and the habits of the *Salmo salar*, common salmon, are described: we shall confine our remarks here to the species of *Salmo* known by the name of trout.

The Bull-trout (S. eriox) is a thicker fish in proportion to its weight than the salmon: the fins and tail are much more muscular; the head is also larger in proportion to its body, and the teeth are longer and stronger. This fish is found abundantly in the Tweed and its tributaries, and also in some of the rivers of the Solway, as well as occasionally in Dorsetshire and Cornwall. The young fish, when they weigh not more than two or three pounds, are called *Whitlings*. As food their flesh is less esteemed than many others of the salmon tribe, as it is coarse (which is quite in accordance with their strong muscular development), and is of a pale orange or yellow colour. In the markets they obtain only an inferior price. The fish known by the name of the Norway Salmon seems to be identical with this species. They take the bait freely, and when hooked, owing to their powerful muscular structure, make prodigious efforts to escape. It is migratory, and attains a weight of about 25 pounds.

The Salmon-trout (S. trutta). This, with the preceding species and the S. salar, are the only migratory species of salmon which inhabit the waters of Great Britain. Next to the salmon itself, the salmon-trout is most esteemed as an article of diet. It has a small head, a very broad back, a slightly forked tail; the flesh is a pink colour, and of a rich flavour. This fish is the white trout of Devonshire, Wales, and Ireland; the sea-trout, herling, and whitling of the Solway, the finnock of the north and west coasts of Scotland; and the salmon-trout of the London market. In their migratory habits and the time and mode of depositing their spawn, they resemble very much the common salmon. The Fordwich Trout of Izaac Walton is the salmon-trout. The best in the London markets are those from Perth, Dundee, Montrose, and Aberdeen. The largest specimen ever seen by Mr. Yarrell weighed 17 pounds.

The Common Trout (S. fario) is an inhabitant of most of the lakes and rivers of Britain, and is perhaps, on account of its colours and form, the most lovely and beautiful creature of its class. The variations of its tints are almost infinite; yellow however is the predominating ground-colour, varying to an orange, and sometimes passing into a dark greenish black or violet, which is covered over with black and red spots. These great variations in its colour seem to depend on the qualities of its food. Those feeding on fresh-water shrimps have the most brilliant colour, and have the finest flesh; whilst those which are obliged to live chiefly on aquatic vegetables have a much less brilliant colour and less delicate flesh. The average weight of the trout is about a pound or a pound and a half; in ponds and stews they sometimes reach a larger size, and specimens have been seen weighing as much as 15 pounds: some of the deep pools in the Thames above Oxford yield the finest trout. The *Gillaroo* trout of Ireland seems to be only a variety of the common trout. Several of the loughs of Ireland produce this fish. Deformed specimens of this common trout are not uncommonly taken, and might lead to the supposition that a new species had been discovered. Mention of varieties from this cause has been made by Oliver, Pennant, and Hansard.

The Great Grey or Lake Trout (S. ferox) was first noticed by Pennant as an inhabitant of Ulswater Lake in Cumberland, and Loch Neagh in Ireland. This fish attains an average weight of 25 pounds, but specimens have been seen weighing 50 or 60. It may be distinguished from the last species by its great size, the large proportional size of the head, and the square extremity of the tail in all its stages of growth. This fish is almost entirely confined to lakes, seldom ascending or descending rivers, and it never migrates to the sea. It is the *S. lacustris* of continental writers; and received its present designation from Sir W. Jardine, who, having found it in Loch Awe and other lochs of Scotland, supposed it was a new species. He named it *ferox*, on account of its exceedingly rapacious habits. The flavour of this fish is indifferent when compared with the salmon and salmon-trout. These fish are generally caught from a boat, and require a rod and line of great strength, on account of their power and activity.

The *Salmo salmulus*, the Parr or Samlet, is sometimes called a trout. It is the smallest of the British Salmonidæ. It very nearly resembles the young of the Salmon, and they were confounded under the name of Parr till Mr. Shaw of Drumlanrigg pointed out the fact that many of the fishes called Parr were young salmon. [SALMONIDÆ.] Some persons suppose from this that all Parr are young salmon; but this is erroneous, as the true Parr are found in the rivers at seasons of the year when a young salmon is not to be found at all. Mr. Yarrell, who has lately paid great attention to this subject, states, 'from close comparative examination of specimens from distant localities, and these with the young of others of the Salmonidæ, I believe the Parr to be a distinct fish.' This fish has various designations in different parts of England. It is the Skegger of the Thames, and the Brandling, Fingerling, Skirling, Gravelling, Lasping, Sparling, &c. of other parts.

The other species of *Salmo* inhabiting Great Britain are the *S. umbla*, the Northern Char, and *S. salvelinus*, the Welsh Char.

(Wilson's *Rod;* Yarrell's *British Fishes.*)

TROVER (from the French word *trouver*, 'to find.'), the name of a special action on the case. It was invented for the purpose of ascertaining the right as between the plaintiff and defendant to the personal chattels which are the subject of it. It is applicable to questions respecting the right to personal chattels only. This action is maintainable by one who has either an absolute or special property in the chattels and also a right to possession. Thus it may be brought either by the actual owner or an occasional bailee, a carrier, &c., or a mere finder as against all except the rightful owner. The declaration states the plaintiff was lawfully possessed as of his own property of certain personal chattels, naming them distinctly, their amount and value; that he afterwards casually lost them, and that they came into the possession of the defendant by *finding*, who, afterwards, converted them to his own use; for which the plaintiff claims damages. This form and the fiction respecting the finding were contrived for the purpose, by assuming a right of possession in the defendant, of enabling the parties to try the bare question as to the right between the plaintiff and defendant to recover or retain the goods. In answer to this declaration the defendant may either plead not guilty, under which plea, since the new rules, the only question raised is the mere fact of the actual conversion, or he may plead specially the circumstances under which, admitting the conversion, he claims a right to detain the goods. The fact of the conversion is proved by showing that the defendant upon request distinctly refused to deliver up the goods, or has destroyed them, or has assumed the right to dispose of them. When an act of conversion has once been completed, no subsequent act by the defendant can, as is said, 'purge the conversion;' that is, the right of action, having once vested in the plaintiff by the act of conversion, will not be divested by any subsequent act of the defendant. But such a subsequent act, as for instance the return of the goods, may reduce the damages to a merely nominal character. The action is not maintainable by one joint tenant, or tenant in common, or partner against another, unless in the case where the chattel has been destroyed by the other. This rule is founded on the principle that the possession of one is, by reason of the joint property of all, held to be the possession of all, and therefore no act of conversion can be said to have been committed.

The other pleas which are an answer to this action are, a denial of the property of the plaintiff in the chattel [PROPERTY; POSSESSION; SALE], or the statute of limitations that six years have elapsed since the act of conversion was committed; or any circumstances showing that the defendant has a right to detain the goods, as from having a lien upon them, &c. [LIEN; STOPPAGE IN TRANSITU.] An inquiry into the character of these defences scarcely belongs to the present article, with the subject of which they are only incidentally connected, and they have already been fully treated on under their respective heads.

The plaintiff must prove that the nature and value of the goods correspond to a certain extent with the statements in the declaration. If he succeeds in obtaining a verdict, the jury may give damages to the amount of the value of the goods, and also such sum in addition as may cover the amount of interest during the time subsequent to the conversion. This action differs from the action of detinue as being brought to recover damages, while the object of the action of detinue is to recover the actual goods in specie. [DETINUE.]

(Selwyn, *N. P.*, 'Trover;' Comyn's *Dig.*, 'Trover.')

TROWBRIDGE, SIR THOMAS. The date of the birth of this eminent commander is not stated in any account we have met with, but he is said to have been the son of Richard Trowbridge, Esq., of Cavendish Street, or Cavendish Square, London. He was brought up in the naval service under Admiral Sir Edward Hughes, in the East Indies; was made a lieutenant in 1780, and a commander and post-captain in 1782. After serving with approbation against the French in India, Trowbridge returned to England in 1785, as captain of the admiral's ship; but he was soon afterwards sent with Commodore (afterwards Admiral) Blankett, upon a particular service in the Indian seas. On his return from that expedition, in command of the Castor frigate, of 32 guns, with a convoy of merchantmen in charge, he was taken prisoner by the French; but while he and about fifty of his crew were being taken home in the Sans Pareil, of 80 guns, they were re-captured, that vessel being taken by Lord Howe, in his great victory of the 1st of June, 1794. Lord Howe gave the command of the Sans Pareil to Trowbridge; and soon afterwards the Admiralty appointed him to the Culloden, of 74 guns, which vessel he commanded in the victory of February 14, 1797, under Earl St. Vincent. Having contributed materially to the success of that day, he was sent with eight ships of the line to support Nelson in the Mediterranean. He was with the fleet which chased Bonaparte to Alexandria, but was prevented from taking an active part in the battle of the Nile, August 1, 1798, by his ship running on a reef early in the afternoon, perhaps owing to the circumstance that he had no chart of the bay, although the other captains had. This accident, observes Brenton, almost broke the heart of the gallant captain; but Nelson assured him that no man could better afford to lose the laurels of the day, and said, in a letter to Earl St. Vincent, that his services merited the highest rewards. 'I have experienced,' he says, 'the ability and activity of his mind and body. It was Trowbridge who equipped the squadron so soon at Syracuse; it was Trowbridge who exerted himself after the action; it was Trowbridge who saved the Culloden, when none that I know in the service would have attempted it; it is Trowbridge whom I have left as myself at Naples; he is, as a friend and as an officer, a *nonpareil*.' The circumstances being represented to the Admiralty, the officers of the Culloden were treated like those actually engaged in the battle. In 1799 Trowbridge resigned the blockade of Alexandria, in which he had been engaged, to Sir Sidney Smith, and he was subsequently engaged about the coast of Italy in co-operating with the Russians and Austrians, and reducing fortresses on the sea-coast. Among his achievements in that year was the capture of the castle of St. Elmo, which the Russians had declared it would require three months to reduce, but which he, with his seamen and marines, and a few Russian and Portuguese troops, took in fourteen days. In November, 1799, Trowbridge was made a baronet as a reward for his services. He had for some time previously borne the rank of commodore, and on his return to England, in 1801, he was selected by Earl St. Vincent to be his captain of the Channel fleet, and was subsequently made a lord of the Admiralty. In April, 1804, he was made an admiral, and in 1805 he was sent to the East Indies in the Blenheim, a 90-gun ship reduced to 74 guns, with a convoy of ten merchant vessels. In 1806 the Blenheim ran aground in the straits of Malacca, and was seriously injured; but after repairing her in a temporary manner at Pulo Penang, Trowbridge sailed in her, under jury-masts, to Madras, where he was urged to leave her, because of her dangerous condition. His characteristic love of coping with difficulties led him to disregard these warnings, and on the 12th of January, 1807, he set sail for the Cape of Good Hope. The Blenheim was last seen on the 1st of February, near Madagascar, in a violent gale, and exhibiting signals of distress; and nothing was ever discovered respecting the fate of her crew. Trowbridge left a son and a daughter, the former, Sir Edward Thomas Trowbridge, being also a distinguished naval officer.

(Debrett's *Baronetage*; James's *Naval History*; Brenton's *Naval History*.)

TROY (Τροια, Τροίη, or Τροτα) is the name both of the country in which the city of Troy was situated and of the city itself. The country of Troy, more commonly called Troas, formed the north-western part of Mysia in Asia Minor. In after-ages this tract of country preserved its name, and under the Romans it formed a separate district of MYSIA. It was bounded on the west and north-west by the Ægean Sea and the Hellespont, the extent of its coast being from the promontory of Lectum on the south to the river Rhodius, which falls into the Hellespont below Abydos on the north. Its eastern boundary was a ridge of Mount Ida, extending from the source of the Rhodius to the sea-coast near the promontory of Lectum. Strabo gives a much greater extent to the Troad, making it reach to the river Æsepus on the east, and to the Caïcus on the south (xiii., p. 581-586); but, in taking this view, Strabo included as subjects of the king of Troy several states which were only his allies. (Homer, *Iliad*, ii., 824, &c.)

The inhabitants of the Troad were most probably of Thracian origin. (Strabo, p. 590; Diodorus, v. 47-49; Herod., vii. 75.) At the time of the Trojan war they had reached a higher state of prosperity and civilization than their opponents the Achæans. There seems however to have been no considerable town in the district except the capital, Ilium or Troy. The cities mentioned by Homer would seem, from the ease with which they were taken, to have been nothing more than villages (*Il.*, ix., 328, &c.).

The whole of the Troad is intersected by the branches of Mount Ida (*Kas-daghi*), which, on account of the number of projections thrown out from the main ridge. the antients compared to the insect called *centipede*. Two of its summits, which bore special names, were Cotylus and Gargara. (*Il.*, viii. 45, &c.)

The following were the principal places in the Troad at the time of Strabo. Near the promontory Lectum, in a plain called, from the abundance of salt in it, Halesium, were the villages of Hamaxitus and Chrysa. At the latter. which stood on the coast, was the temple of Apollo Smintheus (*Il.*, i. 37), which was still standing in the time of Pliny. Scepsis was so called from its having been first built on the highest summit of Ida, whence, according to Strabo, it was removed to a spot 60 stadia lower by Scamandrius, the son of Hector, and Ascanius, the son of Æneas. Strabo elsewhere calls Scepsis a colony of the Milesians. This was the spot where Aristotle and Theophrastus collected a library, which, after passing through several hands, and suffering much damage, was removed by Sulla to Athens. Alexandria Troas, on the coast, a little to the north of Chrysa, was founded by Antigonus, who peopled it with the inhabitants of several neighbouring places. According to Suetonius, Julius Cæsar once thought of making Alexandria the capital of the Roman empire. Herodes Atticus built an aqueduct, by which the town was supplied with water from Mount Ida. The number of splendid buildings which the town once possessed is proved by its ruins, which still exist at Eski-stambul. From Alexandria to the promontory Sigeum (*Yenishehr*) the coast was called Achaium. The promontory of Sigeum formed the southern side of the entrance to the Hellespont, and near it was a town of the same name, which the Athenians took from the Mitylenæans (B.C. 606). This contest is made memorable by the prowess of Pittacus, who commanded the Mitylenæans, and slew in single combat Phrynon, the leader of the Athenians, and by the disaster of the poet Alcæus, who left his shield on the field of battle. (Herod., v. 95; Strabo, xiii., p. 600.) Near Sigeum was the Achilleum, a mound of earth supposed to be the grave of Achilles, and honoured as such by Alexander the Great and Julius Cæsar. Not far to the east of Sigeum was Rhœteum, and near it the Æantium, or monument of the Telamonian Ajax. The coast between Sigeum and Rhœteum was, according to Strabo, the naval station of the Greeks during the siege of Troy. Here is the mouth of the united rivers of Simois and Scamander or Xanthus. The Simois is now called *Mendere-Chai*. The principal city in Troas was Troy, in antient times more commonly called Ilium (Ἴλιον), which exercised a kind of sovereignty over the other towns of the country. Its site, which has been the subject of so much discussion in modern times, is placed, according to the investigations made on the spot by Dr. von Eckenbrecher, upon the western branch of a range of hills extending from the river Simois into the plain towards the river Scamander. Its citadel lay on the south-eastern side of the city. Others, as Pococke, Le Chevalier, Choiseul Gouffier, have traced its site a little farther north in the modern Turkish village of Bunar-Bashi: others again have denied the existence of antient Troy altogether, or have declared it to be a useless task to investigate its site, since it was totally destroyed by the Greeks, and abandoned by its inhabitants. But even this last opinion is too sweeping, since, although Troy may have been destroyed by the Greeks, Homer, who cannot have been mistaken on this point, clearly suggests, and is borne out by Strabo, that, after the calamity that befell Troy in the reign of Priam, it continued, at least for some time, to be ruled over by the Æneadæ, a branch of the house of Priam. The city of Troy which Xerxes (Herod., vii. 42, &c.) and afterwards Alexander the Great visited may have been of later origin, but it is nevertheless attested that it was built on the site of the antient Troy. This town appears to have gradually decayed after the time of Alexander, and a new town of the same name was built somewhat below the spot where the Simois is joined by the Scamander. (Strab., xiii., p. 597.) In the times of the Romans this Troy was regarded and treated as the genuine antient Troy from which they derived their descent.

The first king in Troas is said to have been Teucer, whence the Trojans are also called Teucrians. Dardanus, one of the neighbouring chiefs, married a daughter of Teucer, by whom he had two sons, Ilus and Erichthonius. The latter became the father of Tros, from whom the names Troy and Troas are derived. He had three sons, one of whom, Ilus, founded the town of Ilium or Troy, which became the capital of the country of Troas. In the reign of his successor, Laomedon, the city was said to have been fortified with walls by the assistance of Poseidon (Neptune) and Apollo. Soon after this Troy was taken by Hercules, but was restored to Priam, the son of Laomedon, who reigned for a long time in peace and prosperity, until his kingdom was attacked by the united forces of the Greeks, in consequence of his son Paris having carried off Helen, the wife of Menelaus. After a siege of nine years the Greeks took and destroyed the city of Troy. This event is usually placed about the year B.C. 1184. After this time the history of Troy, which until then is thoroughly mythical, is completely lost to us, although, as we indicated above, it must have continued for a considerable time afterwards.

The most important among the remaining towns of the Troad were Dardanus (the capital of Æneas), Thebe, and Thymbra.

Upon the topography of Troy and its neighbourhood we need not mention the earlier works of Pococke, Le Chevalier, Choiseul Gouffier, Spon, Wood, Wheeler, and others. Those who seek more complete information may consult Leake, *Travels in Asia Minor*, c. 6; Forchhammer in the *Journal of the Geographical Society of London*, vol. xii., whose essay is accompanied by a topographical survey of the Plain of Troy by Captain Graves, T. A. B. Spratt, and other officers of the Royal British Navy. Von Eckenbrecher. *Ueber die Lage des Homerischen Ilion*, in the *Rheinisches Museum für Philologie*, for 1842, p. 1-49, with two maps, one representing the antient and another the modern condition of the country. Compare also Strabo, xiii., at the beginning; Plin., *H. N.*, c. 30 or 33; Mannert, *Geographie der Griechen und Römer*, vi. 3. p. 449, &c.; Georgii, *Alte Geographie*, i. p. 113, &c.

Besides the celebrated Troy, there are some other towns in antiquity which bore this name. 1. A village near Memphis in Egypt, and near a mountain called the Trojan mount (Τρωικὸν ὄρος; Strab., xvii., p. 809). It was believed to have been founded by the Trojans who accompanied Menelaus. 2. In Latium, on the spot where Æneas and his Trojans landed on their arrival in Italy (Dionys. Hal., i. 53; comp. Stephanus Byz., under Τροία, who mentions some more places of the same name.

TROY, AMERICA. [New York.]

TROY WEIGHT. Neither the etymology nor the time of introduction of this denomination is well known; the received opinion is that it took its name from a weight used at the fair of Troyes: this is likely enough, since we find more than one large town, the weights of which became standards: thus we have the pound of Cologne, of Toulouse, and, perhaps, also of Troyes.

That there was a very old English standard pound of twelve ounces is a well determined fact; and also that this pound existed long before the name Troy was given to it or another. There was also the merchants' pound of fifteen ounces, and the Tower pound, having twelve ounces of its own, but less than the Troy pound by three quarters of an ounce. Though the troy pound was mentioned as a known weight in 2 Henry V., cap. 4 (A.D. 1414), and 2 Henry VI., cap. 13 (A.D. 1423), the term troy was not applied to the legal standard pound till 12 Henry VII. (A.D. 1495). The merchants' pound seems to have been the origin of Averdupois weight.

The troy pound has continued to be the legal standard down to the present time, though only actually used in weighing precious metals and stones, and apothecaries' drugs. It had precisely the same limitation of use in the time of Fleta, who is supposed to have lived in the time of Edward I. There is no doubt that it was originally the pound of silver, the pound sterling, and there is evidence that this pound was sometimes described as divided into twenty parts called sterling shillings. The famous statute of Henry I. (A.D. 1266) [Sterling] makes a standard for it from the weight of ears of wheat.

The pound troy is now divided, for gold and silver, into twelve ounces, each ounce into twenty pennyweights, and each pennyweight into twenty-four grains. But for medicines, it is divided into twelve ounces, each ounce into eight drams or drachms, each drachm into three scruples, and each scruple into twenty grains. A cubic foot of water weighs 75·7374 pounds troy. [Weights and Measures.]

TROY, FRANCIS DE, was born in 1648, and was the son of Nicholas de Troy, under whom he commenced his studies, but, at the age of nineteen, became a disciple of Nicholas Loir at Paris. At the beginning of his career as an artist he painted historical subjects, which however he partly abandoned, being more inclined to portrait: but, on being appointed professor in the Academy, he had to paint, according to custom, an historical picture, and chose for his subject Mercury and Argus, which was so highly admired that he immediately received commissions to paint several both sacred and profane subjects, among which was a very fine picture for the church of St. Geneviève. He likewise painted for the duke of Maine a grand picture containing fifty figures the size of life, representing Æneas relating to Dido and her court the history of his adventures.

Louis XIV. sent him to Münich to paint the portrait of the Princess Anne Maria Christina, who was to be married to the dauphin. He received the greatest encomiums for the beautiful colouring and the delicate finishing of this portrait, and especially for preserving the lively and intelligent expression of the countenance. Both the Florentine and French writers agree in commending the style and colouring of De Troy. He died in 1730, aged 85 years.

(Pilkington, *Lives of the Painters*, edited by Fuseli; Bryan's *Dictionary of Painters and Engravers*.)

TROY, JOHN FRANCIS DE, born at Paris in 1676, was instructed in his art by his father Francis. When he had made considerable progress, he went to Italy, and having studied at Pisa and Rome, returned to Paris, where he acquired great reputation as an historical painter, so that Louis XIV. conferred on him the order of St. Michael, and afterwards appointed him director of the French academy at Rome; a station which he filled with great honour, setting a bright example to the young students, not only by his own industry and devotedness to his profession, but by his private virtues. He died in 1752, at the age of seventy-six years.

The portraits of this artist and of his father, painted by themselves, are placed among those of celebrated painters in the Florence Gallery.

(Pilkington, *Lives of the Painters*, edited by Fuseli; Bryan's *Dictionary of Painters and Engravers*.)

TROYES, a city in France, capital of the department of Aube, 86 miles in a direct line south-east of Paris, 94 miles by the road through Provins and Nogent-sur-Seine, or 105 miles by Melun and Sens; in 48° 18′ N. lat. and 4° 5′ E. long.

Troyes was known to the antients by the name of Augustobona ('Itinerarium Antonini') or Augustobana (Αὐγουστόβανα, Ptolemy), and was the chief town of the Trecasses or Tricasses, a Celtic nation, from whom it took, towards the close of the Roman period, the name of Tricasses, Trecasses, Trecases, or Tricassæ (for it is thus variously written), and at a period still later that of Trecæ (Gregory of Tours), from the oblique cases of which the modern name Troyes has been derived. It was plundered by the Normans A.D. 889, and in the feudal period was the capital of the important county of Troyes or Champagne; the manufactures of the town date from the time of Thibaut or Thibaud IV., count of Champagne (A.D. 1102 to 1152). In the civil troubles of the reign of Charles VI., Troyes was taken by the duke of Bourgogne or Burgundy, A.D. 1415; and here, A.D. 1420, the marriage of Henry V. of England with Catherine of France, daughter of Charles VI., was concluded, and the treaty arranged by which Henry was appointed to succeed Charles VI. on the throne. Troyes was retaken from the English by Charles VII., A.D. 1429.

Troyes is on the left bank of the Seine, which flows on the northern and eastern sides of the town: it is surrounded by walls, which, though antient, are in tolerably good condition, and is entered by six gates. The ramparts are planted with trees, and there are other trees at their foot, so that the town is surrounded by a double alley of trees: the ditch also is laid out as a garden. There are five faubourgs or suburbs. The streets are irregularly laid out, and are, with some exceptions, narrow and crooked; the houses, many of which are of wood, are generally ill-built; and in fact the town has undergone comparatively little alteration for the last four centuries: the gables towards the streets are built of wood painted or plastered, and are frequently adorned with coarse carving, and have dark penthouses which overhang the shops. Vaysse de Villiers mentions that the houses built in modern times, with a framework of timber covered with plaster, are some of them so light that they are built and kept in store; and removed when purchased to the spot where the purchaser desires to have them fixed; and that sometimes they are afterwards removed bodily. The neighbourhood of the town is pleasant:

There are three parish churches, namely, the Cathedral of St. Pierre, St. Jean, and La Sainte Madeleine; and five succursal churches, or chapels-of-ease, namely, St. Nicolas, St. Pantaléon, St. Remi, St. Urbain, and St. Nizier. The Cathedral of St. Pierre is a fine specimen of Gothic architecture, though not equal to some other of the French cathedrals in size: the height and width of the nave, the beautiful coloured windows, in good preservation, which adorn the side aisles of the nave, especially three beautiful rose or circular windows, and the handsome pavement of the choir, are among the features which attract the greatest notice. The exterior of the church is less worthy of attention than the interior; the plan has never been completed: there were to have been two western towers, but one only, 192 French feet, or about 205 English feet high, has been erected. The church of St. Jean is remarkable for the narrowness of the nave: it contains a fine tabernacle (a shrine placed on the altar to contain the pyx), sculptured by Girardon; and a fine painting of the baptism of Christ, by Mignard. The church of St. Remi contains a figure of Christ in bronze, by Girardon, regarded as one of the finest works of that sculptor. The churches of La Sainte Madeleine and St. Urbain are considered as very beautiful, and St. Nicolas has a handsome front. All the churches of Troyes are more or less rich in painted windows: those of St. Nizier and St. Pantaléon are in black and white; those of La Madeleine are equally beautiful for colouring and for design. Of the other public buildings, the Hôtel Dieu, or hospital, is a handsome building of the last century, remarkable for a fine iron railing which separates the garden or court from the street: the Hôtel de Ville, or town-hall, has a handsome stone front, the work of Mansard, adorned with columns of black marble; the gate of St. Jacques or St. James, flanked by two towers and surmounted by a light spire, is sometimes ascribed to Cæsar, though it appears to have nothing of the Roman character about it. There are beside these the theatre, the episcopal palace, the wine-mart, the abattoirs or slaughter-houses, the shambles, and the gaol and house of correction.

The population of the commune of Troyes in 1826 was 25,587; in 1831, 23,749 for the town, or 39,143 for the whole commune; in 1836, 25,563. The manufactures of Troyes are important, and are promoted by the distribution of the waters of the Seine through the town, by means of numerous canals which were constructed by Thibaud IV., count of Champagne, in the 12th century: the chief articles made are cotton and woollen yarn, cotton hose, printed cottons, dimities, tapes, and other cotton goods; blankets, flannel, cloth, and other woollen goods; linens, printing paper, playing cards, chamois and other leather, gloves, leather breeches, hats, wool-cards and combs, spinning-wheels, knitting-needles, agricultural implements, furniture, musical strings, leaden utensils and wares, and whiting. There are dye-houses, bleach-grounds, bleaching-houses for wax, and tan-mills. The weaving and knitting of hosiery, which form a principal branch of the manufacturing industry of Troyes, are carried on by the peasantry in the rural districts, who combine this manufacture with their agricultural pursuits. The condition of the workpeople, whether peasants or town workmen, has much improved since the Revolution: they now obtain better wages, are neatly and even smartly dressed, and eat meat. There are five fairs, two of eight days each. In the latter part of the middle ages the fairs of Troyes were of great importance; and a large portion of the trade of France with Germany and Switzerland was transacted at them. The navigation of the Seine at the beginning of the last century commenced at Troyes; but through the neglect of the works needful to keep up the navigation, the river has ceased to be navigable above Méry, which is many miles below Troyes. In 1806 a canal to follow the course of the Seine, from Troyes to the junction of the Aube, was commenced by order of Napoleon; the works were suspended in 1814, but recommenced in 1826; we are not aware what progress they have since made. Several important roads converge at Troyes.

Troyes is the seat of a bishopric, the diocese comprehends the department of Aube; the bishop is a suffragan of the archbishop of Sens and Auxerre. There are several fiscal and administrative government offices; a tribunal de prémière instance, or subordinate court of justice; a tribunal de commerce, or commercial court; three justices of the peace, with their respective cantons or districts; a chamber of commerce, and a council of prud'hommes; a prison and house of correction, baths and a theatre.

Printing was established at Troyes about the middle of the 15th century, and there were a few years since five printing-offices. The public library contains 45,000 volumes and 4000 manuscripts. There are a society of agriculture, science, arts, and literature; two seminaries for the priesthood; a high school; a free school for drawing and architecture; and a mercantile school. There are a society of maternal charity, and four hospitals or asylums, including one for the aged of both sexes and for poor orphan boys, and one for poor orphan girls. Troyes was the native place of Pope Urban IV., the son of a shoemaker; of Juvenal des Ursins, an historian of the middle ages; of the brothers Pierre and François Pithou, and of Jean Passerat, all three distinguished at the revival of learning, and the last one of the authors of '*Le Satire Ménippée*;' of the sculptor Girardon, and the painter Mignard. The arrondissement of Troyes comprehended in 1833 a hundred and twenty-two communes; the population in 1831 was 87,431. It is subdivided into nine cantons or districts, each under a justice of the peace.

(Malte-Brun, *Géographie Universelle*, *Dictionnaire Géographique Universel*; Dupin, *Forces Productives de la France*; Vaysse de Villiers, *Itinéraire Descriptif de la France*.)

TRUCK SYSTEM. TRUCK ACT. Truck, which means exchange or barter, has come to be appropriated to signify the payment of wages of labour in goods, and not in money. By the truck-system is meant this mode of paying wages, together with the mass of its tendencies and results. The Truck Act, 1 & 2 Will. IV., cc. 36, 37, is an act passed in 1831, which, repealing all the previous acts passed for the same purpose, provided anew and more stringently for the prevention of payment of wages in truck in the departments of industry therein enumerated. The wages of agricultural labourers and domestic servants are exempted from the operation of the act. The evidence published in the Report of the Select Committee of the House of Commons appointed in the last session (1842) 'to inquire into the operation of the law which prohibits the payment of wages in goods, or otherwise than in the current coin of the realm, and into the alleged violations and defects of the existing enactments,' shows that, notwithstanding the Truck Act, the truck-system is still in extensive operation in mills, factories, iron-works, collieries, and stone-quarries in the kingdom, and abundantly illustrates the evil tendencies of the system. These evil tendencies will be found also ably explained in the debates in parliament to which the introduction of the Truck Act gave rise in the years 1830 and 1831, and especially in the speeches of Mr. Littleton (now Lord Hatherton), the author of the act, Mr. Herries, and Mr. Huskisson.

It is to be observed, in the outset, that the chief part of the evils of what is called the truck-system is incidental, and not essential to the payment of wages in truck, arising out of the power of the master over the workman, which enables the former to use this mode of paying wages to defraud and oppress the latter. A master may pay the wages of his workmen wholly or in part in truck, in articles of food, clothing, &c., either by agreement, or with only the understood consent of his workmen; and if he supply these articles at prices no higher than those at which they are to be procured elsewhere, and study to meet the various wants of the workmen and their families, the utmost harm that can result is the loss to the workmen of the moral and economical lessons which the disbursement by themselves of weekly money-wages is fitted to supply, and the interference with the business and profits of neighbouring retail shopkeepers; and there will always in such cases be some advantage to set against these, so far as they go, evil results. Thus if some workmen would husband money-wages carefully, and cultivate habits of prudence, others would probably spend recklessly and at the alehouse what the system of payment adopted by masters such as we are speaking of effectually devotes to useful and proper purposes; and if custom is thus taken away from neighbouring tradesmen, better articles are probably supplied, and at lower prices, by masters who consult the convenience and comfort of their workmen, and who are not dependent, as tradesmen are, on retail profits. There are indeed circumstances under which the truck-system, practised by wise and benevolent masters, is a great benefit, without alloy of evil. Large works are carried on in remote districts where there are no shops, or so few, that in the absence of sufficient competition, they are both bad and dear. These works give constant employ to a large number of workmen, who are born, live, and die on the works: the master of the works supplies them from stores of his own with necessaries and other articles at wholesale prices, setting what they have against their wages: he provides medical attendance and schools for their children, towards which he stops small portions of their wages; and establishes benefit-clubs, to which he makes them contribute in the same way: here no tradesmen are injured, and the workmen are greatly benefited by the favourable terms on which they obtain commodities, and by all the other benevolent arrangements of the master, which fulfil purposes generally sacrificed where the truck-system is adopted. Such a case as this was supplied by Sir John Guest's iron-works at Dowlas in Glamorganshire, an interesting account of which is contained in Mr. Thomas Evans's evidence in the 'Report on Payment of Wages' (pp. 64-8). The truck-shop formerly kept on these works was discontinued in 1831, when the Truck Act came into operation. Mr. Evans says:—'They used to buy largely, to keep the prices regular, and in one year they lost 3000*l.* by a purchase of flour: they never raised the price: we were then in an isolated place upon the top of a hill; now we have a town round us.' When notice was given, in 1831, of the discontinuance of the shop, 'the men remonstrated, and asked us to continue it, in order to regulate the prices.' The other arrangements for schools, benefit-clubs, and medical attendance continue.

But it is clear that the circumstances of remote situation and want of shops, which suggest the adoption of the truck-system, and render it capable of being used with peculiar advantage, also imply a want of competition of employers of labour, and difficulty for the workman to leave his employer, and thus increase the danger of its being used to the detriment of the workmen. Where the truck-system acts beneficially, it is owing entirely to the justice and benevolence of the individual truck-masters. On the character of the master everything depends. In the hands of masters of opposite character, and under circumstances, whether of scarcity of employment, of isolated situation, or of combination among masters in the same business or through an extensive district, which place the workman more or less at the mercy of his employer, the payment of wages in truck may be, and continually has been, and is still extensively, used for the defrauding and oppressing of workmen. Masters compel workmen to take goods from them, which are supplied at a higher price than they might be procured from tradesmen; and the workmen's wages are thus actually diminished in amount, while they are still estimated at the same money-rate. They compel the workmen to take articles of inferior quality, or more of a particular article than they desire, which leads to their depriving themselves of other articles that would render their general condition more comfortable; or even articles which they can make no use of at all, and are obliged to sell again, of course at a loss. If the masters do not supply every article needed by the workmen, and the latter have still to go to shopkeepers to supply these, they have little or no money for the purpose, the masters always taking care to stop what is due to themselves at their own prices out of wages; the shopkeepers are less likely to give credit; and if they give it, they stand a great chance of not being paid. In the accounts kept between masters and workmen, the former have all their own way, and the latter are cheated, over and above the cheating of prices; settlements of accounts are at long intervals, and the workmen never know exactly how they stand in their masters' books; some masters make it an object to have the workmen always in debt to them, which increases their hold on the workmen. The workman's means of comfort are diminished, his condition and his character are deteriorated: he does not look beyond the truck-shop, and his wages being absorbed by the master, he has no means of making provision for the future.

These are the evil results of the truck system, and the ways in which injury is done by it to workmen, and at the same time to other masters who do not adopt the truck-system, or who do not use it fraudulently, and who cannot therefore compete in prices with those who do, and to shopkeepers who both lose their customers, in the articles of chief demand among the poor, and have greater difficulty and risk in respect of payment for those articles for which workmen still need to resort to them. We shall select a few instances of these mal-practices from the Report which has been already quoted, premising that what, if there were no law against truck, would be always done directly and openly, is now done by various contrivances, such as tickets negotiable at adjoining shops, which have the names of other persons over the doors, for the purpose of evading the act, which however would seem to be so worded as to be capable of covering almost every artifice instanced in this Report. At the same time truck is practised openly and without attempt at evasion, to a great extent; which shows that the provisions of the act, well contrived as they unquestionably are, are not effectual.

Three witnesses, one of whom had been himself a victim of this injustice, relate the following transaction:—Fifty wool-combers, in the employ of Messrs. Turner and Mitchell, Bradford, were compelled on one occasion to take each a piece of worsted stuff, measuring twenty-eight yards, undyed, for which each was charged 1*l.* 1*s.* It was agreed that 1*s.* a week was to be stopped out of each man's wages, till the stuff was paid for: but at the end of three weeks, each of them was set to a piece of work of the value of 7*s.* 6*d.*, which was all put against each man's debt; and afterwards, before the debts were cleared off, 2*s.* a week was stopped out of the wages. The dyeing and finishing of each piece of stuff cost each man 4*s.* more, and without that, it was neither useable nor saleable. Jeremiah Davidson, one of the men, gives evidence, 'I wanted to sell some of them to my neighbours, but nobody would buy it or have it: it cost me 1*l.* 1*s.* and 4*s.* for dyeing, making 1*l.* 5*s.* the 28 yards; they said at the dearest place they could go to they could get it at 8*d.*, and it stood me in nearly 11*d.* . . . . My mistress cut it up for frocks and petticoats; I had some of them before in the same way that we had to sell to live upon; we had not a bite or a tack to live upon while we were working this lather of wool extra.' (*Report*, pp. 23, 24.) It is an aggravation of the cruelty of this transaction that the men are prohibited by law from hawking the goods thus forced upon them, for sale, without a licence. Davidson had worked for these masters for rather more than two years, and during the whole time had been subject to this practice of supplying goods and stopping wages for them.

John Fisher, working for Mr. Walker, a worsted manufacturer near Bradford, was paid his wages 'part in money, and part of it in potatoes and dirt. . . . . I durst not have any objections for fear of losing my bit of work. I wanted to take three stone of these potatoes; he says, "Oh, three stone will be nothing at all, you might take rather more, it will only be settled at so much a week," and so like he put down half a load for me.' A fortnight after, his master wanted him to take more: 'I said, "We have had a sufficient of them, and have been obliged to sell eight stone of them for 2*s.* 3*d.* on purpose to raise a bit of flour," for I had wife and child very bad in the house at that present, and I was obliged to sell them. . . . . I had to sell them at about 2½*d.* and he charged 5*d.*, and when it was put down to me, instead of having seven stone and a half, I had only seven stone. It was short weight, and in that half load there was 19 lb. nothing but dirt. . . . I wanted to take them the first time by my two hands, this way (*describing it*), and young master said, "We do not allow it in that way; you must take them this way." I wanted to take them without the dirt, and he gave me a shovel and said I must take them up with that; and there was 19 lbs. of dirt.' (*Report*, pp. 15-17.) Fisher had been in the workhouse before being in Mr. Walker's employ, owing to want of employment. The inability to get work elsewhere made him stay with Mr. Walker.

William Morgan, a miner and collier in Monmouthshire, relates that in the Abercan works, the workmen select what goods they want, and get an order on another part of the shop for the money to pay for them. 'We must not take the money away, but pay it all back there; not even one penny to have a pennyworth of balm; and if we want a penny or two to pay any man whatever, we must sell some of these things and lose a penny upon the article: if we want a quarter of potatoes from a huckster, we must sell some of the articles . . . . . I have been forced to buy potatoes with shop things, and pay my lodgings with shop things; and I was not looked on in my lodgings, because I had no money to pay them. I lodged at a baker's house, and I was obliged to bring currants to him to pay the rent, and lose 1*d.* in the pound.' (p. 108.) We select the following cruel example of the working of the system from the evidence of Mr. Pritchard, clerk and cashier in iron-works in Monmouthshire:—It is the case of a workman 'whose child died; he could get no money; there was nothing to be had at the works; he asked for money and it was denied him, but if he chose to take goods out of the shop he was welcome; that was the answer, that he might take goods out of the shop, and bury his child; and he was obliged to take goods up and sell them in order to bury his child.' (p. 113.)

Mr. Shepherd, a grocer and draper in the island of Portland, where the truck-system is universal, says it frequently happens that quarrymen in full work find themselves unexpectedly in debt to their employer, when they have a settlement of accounts, according to the custom of the place, at the end of six months. He mentions an instance of a man who, expecting to receive 5*l.*, found himself brought in 10*s.* in debt. (p. 115.) The Rev. F. D. Perkins of Sowe, near Coventry, gives the following evidence:—'They do not know how their account is going on, and they overrun it, sometimes without meaning to do so; that is, the poor people cannot read, the account is kept by the master, and the workmen have books. I have seen these books, purporting to be a list of the articles which they have had, but it was impossible to understand it, for the accounts are kept in hieroglyphics. I have said to a man, "How does your account stand?" and he has said, "I do not know." "What does this mean?" I have said: "I do not know." . . . . The account appears to be kept in a way that the master can alone tell what it means; the men are not at all aware of what they are spending.' (p. 141.)

The following are instances of the amount of profits realized by the practice of truck. Mr. Oldfield, clerk to Messrs. Stainton and Jones, solicitors, Chorley, Lancashire, states that 'the whole of the mill-owners in Chorley, with the exception of one in the cotton-trade, are in the habit of getting something like 50 per cent. out of the shop.' (p. 84.) Autey, a hosier, at Bradford, estimates the profits made by the truck-masters about Bradford at 25 per cent. on the goods they supply. 'I will give you the instance of a person living three miles from Shipley, at Idle: . . . . she can purchase goods in Idle at 5*s.* in the pound less than she can at the shop; when she has to take them out for work, she pays 4*d.* to 6*d.* per stone upon flour, 1*d.* per pound upon sugar, 2*d.* per pound upon tea and oatmeal, cheese, bacon, and other articles in the same ratio.' Two miners from Monmouthshire state that they would rather receive 15*s.* a-week in money, and could do better with it than their present nominal wages of 1*l.* paid in truck. (*Evidence of W. Morgan*, p. 108, *and of Howard*, p. 110.) Mr. Shepherd, of Portland, is asked, with reference to the quarry-masters of that island: 'What do you suppose the profits of the employer to be per cent. on the supply of the articles?—I should say from 15 to 20 per cent.' 'Have they ever run as high as 25 or 30 per cent.?—I cannot say that; I think they do.' (p. 116.) Mr. Shepherd produced bills in which Portland quarrymen are charged 60*s.* and 65*s.* for a sack of flour, which is bought at Weymouth and imported into Portland for 48*s.*

These are a few instances selected out of the many contained in the very interesting Report of the Select Committee on the Payment of Wages of the evils of the truck-system. The reader is now in a condition to compare the evil tendencies of the payment of wages in truck with its tendencies for good. It is to be feared, from the nature of the case, that the number of masters who will use it to the injury of their workmen will preponderate greatly over the number of those who will use it for their benefit; and the results realize this apprehension. The cases in which, with good masters, it is capable of being turned to the decided advantage of the workmen are, after all, necessarily very few; and in these cases the good may always be effected by shops kept by persons other than the master, who are brought there by him, and who are necessarily, from the custom which is within the master's control, amenable to his influence. Besides, shops will be found in a short time where they are wanted. Generally, where the system is practised even by good masters, there will be disadvantage as well as advantage. Where the masters who practise it are not benevolent and just, the evils to which it may be turned are those that we have described and exemplified; and the power which the master possesses over his workmen, the profit which he may make by using truck fraudulently and oppressively, and the abundance of labour in proportion to employment which generally exists in a country considerably advanced in civilization, combine to produce extensive evil from the truck-system. And the evil always increases with the increase of other evils which fall hardest on the labouring classes,—with a crippled trade and declining manufactures, which at the same time that they diminish masters' profits and make work more difficult to be obtained, increase the inducement to the master to resort to the truck-system, and diminish the power of the workman to withstand it. Thus in periods of distress, when truck prevails most, it reacts and increases the evils of the distress, aggravates the evils of the condition of the working-classes, and adds to their disaffection. Excitement against the truck-system was mingled in the Luddite riots of 1813; and there is evidence in the Report to which we have so frequently referred of its having had a share in the late riots in the mining-districts of Monmouthshire (*Evidence of Phillips*, p. 76, *and of W. Morgan*, p. 110), and of its having been a chief cause in producing riots among the nailers of Dudley in the spring of the present year (1842). (*Evidence of Lewis*, p. 52.)

We have no hesitation therefore in advocating the prohibition of payment of wages in truck; and we do not think that much benefit would be derived from a plan recommended by one or two witnesses before the Committee, in lieu of total prohibition, which we will give in the words of one of them, Mr. James Smith, of Deanston. 'If any law could be formed to have it done by licence, so that the master should be licensed to supply the people by truck, under certain regulations as to the mode by which it should be done, and that it should be brought by some simple process under the review of some of the local courts, either the sheriff or quarter-sessions, or the ordinary meetings of justices, it would be very beneficial' (p. 71.) (See also the *Evidence of Mr. W. Dixon*, p. 80.) The good to be derived under certain circumstances from a truck-shop kept by the master, may, as we have already observed, be always derived, with the master's aid, from a shop kept by some one else; and we cannot conceive the possibility of a licensing system which would be proof against all the means of evasion to which truck-masters may and will resort. It is right to add that the two witnesses whom we have quoted are both from Scotland, where a law which gives tradesmen a power of arresting wages in the hands of masters for workmen's debts, and which is found very grievous to the working-classes, who are encouraged by tradesmen to contract debts and then persecuted with this law, renders the truck-system a relief from the oppressions of tradesmen, and gives it a peculiar and local value.

There have always however been found persons to contend against any legislation whatever on this subject; and it will be well to consider briefly the argument by which the opinion of such persons is principally supported.

Legislation against truck is often condemned as an interference with the rate of wages, which is governed by certain natural laws, and which the legislature cannot attempt to regulate without doing mischief. But there is an obvious distinction between the rate of wages, and a particular mode of paying wages which affords facilities to the master of cheating and oppressing his workmen, and enables him actually to lower wages while, preserving them at the same money-rate, he does not appear to do so. The object of legislating against truck is not to interfere with the natural laws which govern the rate of wages, but to protect the powerless workman against the master who would increase his own profits fraudulently and at his expense, and to secure to him the advantages to be derived from the regular receipt of money-wages and the management of his own expenditure. It is legislation, not to determine the contracts which shall be made between master and workman, but to secure the latter the fulfilment of the contracts by the payment of wages in full and in money. This distinction was forcibly put by Mr. Huskisson, in his speech on Mr. Littleton's bill, on the 5th of July, 1830,—one of his last speeches. 'Why should the legislature not do towards the poor and helpless part of the community what it had ever been the policy of the law to do towards all those who were unable to protect themselves? It was the duty of every state to ensure the fulfilment of contracts, in the sense in which those contracts were made. There were many instances of the legislature doing this, as well as instances of its interference for the protection of those who could not protect themselves, or who perhaps could protect themselves, but were induced by the acts of others to make improvident bargains. What, for instance, was the act which related to the lending of money upon annuities? That act was passed, not for the protection of persons who were obliged to sell their labour for whatever they could obtain for it, not for the protection of the most helpless, the least informed, the most friendless part of society, but for the protection of those who might be obliged, from circumstances, to have recourse to money-lenders. That act provided that every contract should be void unless the payment, contracted for in money, should be actually paid in money. Why then should we not extend the same protection to those who had no friend to guide them, and who looked up to the legislature as their shield against the extortion of those who regarded only their own advantage, and never thought of the sufferings and affections of those whom they employed.' (Huskisson's *Speeches*, vol. iii., p. 626.)

The following is a summary of the Truck Act, often known as Mr. Littleton's Act, which was passed in 1831. It declares all contracts for hiring of the artificers afterwards enumerated, by which wages are made payable wholly or in part otherwise than in the current coin of the realm, or which contain regulations as to the expenditure of wages, to be illegal, null, and void. All payment of wages is to be in money entire; and any payment of wages in goods is declared illegal. Wages which have been paid otherwise than in the current coin of the realm are made recoverable; and in an action brought for the recovery of wages, no set-off is to be allowed for goods given in payment of wages, or for goods sold at any shop in which the employer has an interest. Employers are denied an action in return against artificers for goods which have been supplied in payment of wages. If workmen or their wives or children become chargeable to the parish, overseers may recover from their employers wages which have been earned within three months previous, and have not been paid in money. The penalty on employers making the illegal contracts or illegal payments of wages, to be for the first offence a sum not greater than 10*l*. nor less than 5*l*.; for the second a sum not greater than 20*l*. nor less than 10*l*.; and the third offence is declared a misdemeanor; and the employer who has been convicted, to be punishable by fine within the discretion of the convicting magistrates, but not in a sum greater than 100*l*. The convicting justices are empowered to award a portion of the penalty, which shall never exceed 20*l*., to the informer. The penalties may be sued for and recovered by any one before two justices of the peace having jurisdiction in the county, riding, city, or place within which the offence has been committed. No justice of the peace being engaged in any of the trades or manufactures enumerated in the act, or the father, son, or brother of such person, shall act as a justice of the peace under this act; and provision is made for county magistrates taking the place of borough magistrates thus disqualified. Justices are empowered to compel attendance of witnesses. Power is given to levy the penalties by distress. A member of a partnership is not liable personally for the offence of his partner, but distress may be made on the partnership property. The 19th clause thus enumerates the artificers to whom the act relates:—'artificers employed in or about the making, casting, converting, or manufacturing of iron or steel, or any parts, branches, or processes thereof, or in or about the working or getting of stone, salt, or clay; or in or about the making or preparing of salt, bricks, tiles, or quarries; or in or about the making or manufacturing of any kinds of nails, chains, rivets, anvils, vices, spades, shovels, screws, keys, locks, bolts, hinges, or any other articles or hardwares made of iron or steel, or of iron and steel combined, or of any plated articles of cutlery, or of any goods or wares made of brass, tin, lead, pewter, or other metal; or of any japanned goods or wares whatsoever; or in or about the making, spinning, throwing, twisting, doubling, winding, weaving, combing, knitting, bleaching, dyeing, printing, or otherwise preparing of any woollen, worsted, yarn, stuff, jersey, linen, fustian, cloth, serge, cotton, leather, fur, hemp, flax, mohair, or silk manufactures; or in or about any manufactures whatsoever made of the said last-mentioned materials, whether the same be or be not mixed one with another, or in or about the making or otherwise preparing, ornamenting, or finishing of any glass, porcelain, china, or earthenware whatsoever; or any parts, branches, or processes thereof, or any materials used in any of such last-mentioned trades or employments; or in or about the making or preparing of bone, thread, silk, or cotton-lace, or of lace made of any mixed materials.' Domestic servants and servants in husbandry are exempted from the act. The 23rd clause declares that nothing in the act shall prevent the supplying to artificers of medicine or medical attendance, of fuel, materials, tools or implements to be used in his trade or occupation if a miner; or of hay, corn, or other provender to be consumed by any horse or beast of burden, or the letting to any artificer the whole or part of any tenement, or the supplying of victuals dressed under the roof of any employer and there consumed; and making deduction of wages on any of the above accounts, or on account of money advanced, 'provided always that such stoppage or deduction shall not exceed the real and true value of such fuel, materials, tools, implements, hay, corn and provender, and shall not be in any case made from the wages of such artificer unless the agreement or contract for such stoppage or deduction shall be in writing and signed by such artificer.' The interpretation clause (25th) gives a most extensive meaning to the word contract: 'Any agreement, understanding, device, contrivance, collusion, or arrangement whatsoever on the subject of wages, whether written or oral, whether direct or indirect, to which the employer and artificer are parties or are assenting, or by which they are mutually bound to each other, or whereby either of them shall have endeavoured to impose an obligation on the other.'

Such are the provisions of the Truck Act. Well adapted, as it would appear, for the purpose of protecting the workman against this species of oppression by his master, it is yet extensively violated and evaded. The attention which has lately been called to this subject by discussions in parliament, and by the Report of the Committee whose investigation of this subject has been the first ever instituted by the legislature, will probably have the effect of inducing the government to appoint inspectors to secure the effectual carrying out of the act.

The evidence published by the Select Committee on Payment of Wages shows that the truck system is practised extensively in the cloth manufactories about Bradford in Yorkshire; in the mills in Lancashire, especially about Bury; in the nail-trade at and about Dudley in Staffordshire, where it is carried on principally by a set of men called factors or foggers, who are middlemen between the nailors and the nail-ironmongers (see the interesting evidence of Mr. Lewis, pp. 51-64); in the collieries and ironworks of Monmouthshire and Glamorganshire; in the stone-quarries of the Isle of Portland, where the usual time for settlement of accounts is six months, and sometimes accounts are not settled in twelve months or eighteen months (see the valuable evidence of Mr. Shepherd, pp. 113-9); and in the agricultural counties of Devon, Dorset, and Somerset, among the farmers, to whom the present act does not apply, but whom there does not appear to be any proper reason for excepting from legislation against truck.

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(See the evidence of the Rev. C. E. Walkey, of Laurence St. Clyst, Devonshire.) The Rev. W. Ferguson, of Bicester, Oxfordshire, gives evidence as to the practice prevailing in his neighbourhood of paying the agricultural labourers at public-houses in which the farmers have an interest, on Saturday nights, and often even on Sunday mornings. 'The consequence is that they are indirectly compelled to drink; they cannot sit in the public-house doing nothing' (p. 106). This is virtually a form of truck, and a very pernicious one. The witness adds: 'It is one of the finest agricultural districts in England, but I am bold to say that I never met with the labouring classes in such a state of ignorance and immorality. I have lived several years at Newcastle-on-Tyne, where manufactures abound, but I never had an opportunity of seeing anything to be compared with the state of things in Oxfordshire' (p. 167). The truck system prevails extensively in Scotland both in agricultural and manufacturing districts.

The evidence goes to show that in Yorkshire and Lancashire, where truck is practised, it is chiefly among the smaller manufacturers and in the villages; but it occurs also in large towns and with wealthy firms. The factory in which the instance we have cited of the cloth goods forced on fifty woolcombers occurred is described as a large concern. In Dudley very few head nail-ironmongers practise it. (Evidence of Mr. Lewis, p. 57.) It is practised very generally in large iron-works in Monmouthshire and Glamorganshire. The evidence shows also that the practice of truck has been on the increase during the last six or seven years, during which time there has been a steadily increasing depression of trade and manufactures. The spread of truck is a sign of a depressed condition of trade and manufactures; but it is a sign which has evil effects of its own, and which it is right that the state should interfere to get rid of. It makes the prevailing distress fall more hardly than it otherwise would on the workman, who is robbed to relieve the master.

TRUE. (Astronomy.) This word is used in a somewhat technical sense. The place which a star or planet appears to occupy in the heavens is not called its true place, but that which it would occupy if the effects of refraction, parallax, &c., were removed, that is, if the spectator saw from the centre of the earth, and without the light passing through any refracting medium.

TRUFFLE. [TUBERACEÆ.]

TRUMAN, REV. JOSEPH, B.D., an English theological writer of the seventeenth century, whose works have been long neglected and generally forgotten, and of whose personal history very little is known, was born in April, 1631, probably at Gedling in Nottinghamshire, though another account says at Stoke in the same county. His family was of respectable station, and his father appears to have at one time filled some public office. He himself, after beginning his school education at Gedling, under the minister of the parish, Mr. Lawrence Palmer, who was a person of considerable learning, was removed to the free school at Nottingham, and thence proceeded to Cambridge, where he was admitted a pensioner of Clare Hall. All that is known of him after this is, that having finished his studies at the university he was inducted into the living of Cromwell, that he was ejected for refusing to read the Book of Common Prayer soon after the passing of the Act of Uniformity (in 1662), that he then resided for some years in Mansfield, and that he died after a short illness in the house of a friend at Sutton in Bedfordshire on the 29th of July, 1671.

Truman is the author of three small theological treatises: 'The Great Propitiation,' published in 1669; 'An Endeavour to correct some prevailing opinions contrary to the Doctrine of the Church of England,' in 1671; and 'A Discourse of Natural and Moral Impotency,' the same year. All these performances are held by his admirers to display extraordinary powers of ratiocination; but the last is looked upon as his best work. A new edition of it, with a 'Biographical Introduction by Henry Rogers,' was published at London, in small octavo, in 1834; and, whatever may be thought of its right to the rank claimed for it by its modern editor, it certainly deserved to be rescued from oblivion, were it only as a contribution to the history of English metaphysical theology. It is described by Mr. Rogers as 'being the first systematic and elaborate attempt, not so much to establish the doctrine of man's moral inability (still less the doctrine of moral necessity generally), as to illustrate the wide distinction between that and natural inability, to reconcile the former with the idea of human accountability, and to vindicate it from the pernicious consequences which some of its advocates, and all its opponents, would feign [fain] attach to it.'

Truman was a hard student, and was distinguished for his profound and varied learning. One of his favourite studies was English law: he is fond of introducing a legal illustration in his metaphysical expositions and deductions. With all his sharpness of intellect however, it is admitted that he had very little perception of anything out of the province of mere logic. His style is singularly rugged and inartificial, to the extent of being sometimes nearly inexplicable upon any syntactical principle. Though puritanical in the general complexion of his theology, Truman is said to have regarded many of the points upon which his party took their stand in opposition to the established church as sufficiently insignificant; he evinced his conscientiousness by the sacrifice he made in giving up his living rather than comply with all the demands of the law; but after he thus became what was called a nonconformist, although when opportunity served he was always ready to preach to those of his own way of thinking, he continued, we are told, usually to attend the services of the establishment; nor did he drop his intimacy with any of his old friends among the clergy. Among his particular associates are mentioned, besides Baxter, Stillingfleet and Tillotson, the latter of whom had been his fellow-student at Clare Hall. For these particulars we are indebted to the memoir of Truman by Mr. Rogers, who has collected all that is to be found respecting him in Calamy's 'Account of the Ejected Ministers;' Nelson's 'Life of Bishop Bull;' and other sources of information.

TRUMBULL, SIR WILLIAM, a diplomatist and statesman of some eminence, and, during the reign of William III. for some time secretary of state, was born in 1636, at Easthampstead in Berkshire. He was the son of William Trumbull, Esq., of Easthampstead, who represented Berkshire in parliament; and his grandfather, who had the same names, was one of the clerks of the privy council in the reign of James I., and envoy to the court of Brussels from that king and from Charles I. He was brought up at a school at Oakingham, and afterwards went to St. John's College, Oxford, but afterwards became a fellow of All Souls' College. He took the degree of LL.B. in 1659, and of LL.D. in 1667. In the interval between these two degrees he had travelled in France and Italy. After taking the degree of LL.D. he practised as an advocate in Doctor's Commons, and enjoyed an extensive practice. In 1671 he was appointed chancellor and vicar-general of the diocese of Rochester, and in 1672 he obtained the reversion of the clerkship of the signet, then held by Sir Philip Warwick, which came to him on the death of the latter in 1682. In 1683 he accompanied Lord Dartmouth to Tangier in the capacity of judge-advocate of the fleet; and on his return to England he was knighted, and in November, 1685, sent as envoy extraordinary to the court of France.

'He was sent envoy to Paris,' says Burnet, 'on Lord Preston's being recalled. He was there when the edict of Nantes was repealed, and saw the violence of the persecution, and acted a great and worthy part in harbouring many, in covering their effects, and in conveying over their jewels and plate to England, which disgusted the court of France, and was not very acceptable to the court of England, though it was not then thought fit to disown or recall him for it. He had orders to put in memorials complaining of the invasion of the principality of Orange, which he did in so high a strain, that the last of them was like a denunciation of war.' Trumbull was recalled from Paris in 1686, when James II. had thrown off the mask from his designs to establish popery in England with the aid of France; and he was then sent by James II. as ambassador extraordinary to the Ottoman Porte. He remained at Constantinople until 1691, the revolution having occurred while he was there. On his return to England he was appointed a lord of the Treasury; and in May, 1695, secretary of state. He was also governor of the Turkey Company. He resigned the secretaryship of state in December, 1697, and retired to Easthampstead, to pass the remainder of his days in quiet. At the time of his withdrawal from public life, he represented the University of Oxford in parliament. Lord Hardwicke says, in a note to Burnet's 'History of his Own Times' (vol. iv., p. 366, ed. 1833), 'Secretary

Trumbull resigned about this time in disgust with the lords of the regency, who, he said, had used him more like a footman than a secretary.' A similar account of the reason of his retirement is given in the 'Shrewsbury Correspondence.'

Sir William Trumbull occupies a place in literary as well as political history, and has the distinction of having aided Dryden with his counsel while he was engaged in translating the '*Æneid*,' and of having been the first to recommend to Pope the translation of Homer. Dryden thus gracefully mentions him in his 'Postscript to the Æneis:' 'I must also add, that if the last Æneid shine among its fellows, it is owing to the commands of Sir W. Trumbull, one of the principal secretaries of state, who recommended it as his favourite to my care, and for his sake particularly I have made it mine; for who could confess weariness when he enjoined a fresh labour? I could not but invoke the assistance of a muse for this last office:

'" Extremum hunc Arethusa ———————
——————— Neget quis carmina Gallo." '
(Dryden's *Works*, by Scott, vol. xv., p. 190.)

Pope's father lived at Binfield in Windsor Forest, in the immediate neighbourhood of Sir William Trumbull's place at Easthampstead; and here, as is well known, Pope's boyhood and commencing manhood were passed. The old retired statesman and the young poet were almost inseparable companions: they read the Greek and Roman authors together, and were in the habit of riding with one another three or four times a week, and latterly every day. The first of Pope's pastorals was addressed to Sir W. Trumbull:—

'You that, too wise for pride, too good for pow'r,
Enjoy the glory to be great no more,
And carrying with you all the world can boast,
To all the world illustriously are lost!'

When Pope went to London in 1705, he corresponded with 'the amiable old statesman.' Some of the letters which passed between them are printed in Pope's works (Roscoe's edition, vol. viii.). Pope in 1709 published some specimens of translations from Homer, which he had previously communicated in manuscript to Sir William Trumbull. The latter wrote to him (April 9, 1708), 'I am confirmed in my former application to you, and give me leave to renew it upon this occasion, that you would proceed in translating that incomparable poet, to make him speak good English, to dress his admirable characters in your proper, significant, and expressive conceptions, to make his works as useful and instructive to this degenerate age as he was to our friend Horace, when he read him at Præneste:

' "Qui quid sit pulchrum, quid turpe, quid utile, quid non." '
(Pope's *Works*, Roscoe's edition, vol. viii., p. 5.)

When Pope visited Binfield to bid it adieu before taking up his residence at Twickenham, he found Sir William Trumbull dying, and parted from him, as he wrote to his friend Mr. Blount, 'as from a venerable prophet, foretelling with lifted hands the miseries to come, from which he is just going to be removed himself." Sir William Trumbull died on the 14th of December, 1716, aged eighty years.

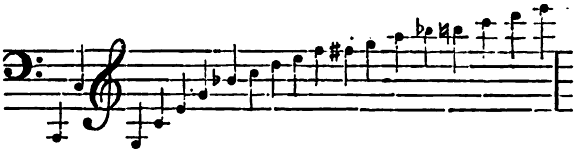
Burnet says of him, that 'he was the eminentest of all our civilians, and was by much the best pleader in those courts, and was a learned, a diligent, and a virtuous man.' Pope's character of him in his 'Epitaph on Sir William Trumbull' is well known:—

'An honest courtier, yet a patriot too,
Just to his prince, and to his country true:
Fill'd with the sense of age, the fire of youth,
A scorn of wrangling, yet a zeal for truth;
A generous faith, from superstition free;
A love to peace, a hate of tyranny:
Such this man was, who now, from earth removed,
At length enjoys the liberty he loved.'

TRUMBULL, JOHN, an American painter, was the son of the governor of Connecticut of that name. He took an active part in the war of independence, and after the peace came to England, with a view of perfecting himself as a painter under West, in order to carry into execution a favourite design of painting a series of pictures of the principal heroes and events of the Revolutionary war. He completed many of these pictures, and several of them have been engraved. The first of this series painted by Trumbull was the Battle of Bunker's Hill, in which General Warren was killed: it was engraved or being engraved by the celebrated J. G. Müller at Stuttgart, in 1796. The death of General Montgomery, another of the series, was engraved by the Danish engraver F. Clemens, in London, in 1798: it is considered Clemens's finest plate. G. Ketterlinus, at St. Petersburg, commenced copies of both these plates, but their completion was interrupted by his death in 1803. Valentine Green also scraped in mezzotint a picture by Trumbull of Washington standing on the sea-shore, with a black in the background holding his horse; and likewise a portrait of Washington. A very fine standing half-length portrait of Washington was engraved by J. Cheesman, after Trumbull. There are other plates by other engravers after this painter. He was still living in 1813. (Meusel; Füssli, &c.)

TRUMPET, a musical instrument of the highest antiquity, which, under different names and forms, has been known in all ages that have left any records, and in all countries, however remote from civilization. Ménage derives the word from στρόμβος, *turbo*, a shell, and this etymology indicates the origin of the instrument, which still appears in what probably was its pristine shape among many barbarous tribes in different parts of the globe. [Buccina.]

The Trumpet is a single tube eight feet long, less in diameter than the horn, doubled up in a parabolic form, sounded by means of a mouth-piece, and subject to the same acoustical laws which govern all instruments of this class. [Horn.] The natural scale of the Trumpet, as given by Karl Bargans (see *Harmonicon*, viii. 23), is as follows:—



'By the assistance of a small brass tube, called the tuning-pipe, or shank, by which the tube of the Trumpet is lengthened, the above number of notes may be increased.' [Harmonics.]

Music for the Trumpet, as in the instance of the horn, is always written in the natural key of c, and the key to which the instrument is to be adapted is pointed out by the composer.

TRUMPETER (Ornithology), the vulgar name for *Psophia crepitans*, misprinted *Trophia crepitans* in the article Agami.

Mr. G. R. Gray makes the *Psophinæ* the first subfamily of his *Ardeidæ*. The *Psophinæ*, in Mr. Gray's arrangement, consist of the genera *Psophia* and Cariama, and immediately precede the *Gruinæ*.

Mr. Swainson placed *Psophia* under the *Megapodinæ*. [Megapodiidæ.]

TRUNCATED, cut off, or abridged. Thus the part of a cone or pyramid which remains when the vertex and parts adjacent are separated from the rest by a plane section, is called a truncated cone or pyramid.

TRUNK OF TREES. [Stem.]

TRURO, a parliamentary borough in the western division of the hundred of Powder in Cornwall, 301 miles west-south-west of the General Post-Office, London; namely 166 by railway to Taunton, and from thence 135 miles by coach-road through Collumpton, Exeter, Ashburton, Plymouth, Devonport, Liskeard, Bodmin, and St. Austell.

The earliest ascertained mention of Truro is in an extant charter of Reginald, earl of Cornwall, about A.D. 1175. In this charter the name is written Triueru, which appears to be derived from two Cornish words, 'tre,' or 'trei' ('three'), and 'ru' (a 'street,' or 'way'), and is interpreted to signify a town at the meeting of three roads or ways. In a later document, A.D. 1262, the name is written 'Treuru,' and in one still later (A.D. 1369) 'Truru.' It is first found under the form Truro in the reign of Henry VII., and from that time almost to the present has been variously written Truru and Truro. (*Gent. Mag.*, Nov., 1838.) Little historical interest attaches to this town. Its market is held by prescription. In A.D. 1540 an act was passed for the repair of some decayed towns, among which Truro is enumerated. In the years following this act the town so far revived, that in 1574 it is recorded to have been one of the most neatly-built places in the western part of Cornwall; and it has in modern times very much increased. The old municipaborough comprehends a part of Kenwyn parish, chiefly occupied for agricultural purposes; and the whole of the parish of St. Mary, which is almost entirely occupied by houses. This latter parish had, in 1831, a population of 2925, and an area of 190 acres. The town however had spread beyond the municipal boundary, and comprehended a considerable proportion of the houses and population in the parish of St. Clement, and in the extra-municipal part of the parish of Kenwyn: St. Clement's parish had an area of 3520 acres, and a population of 2885; Kenwyn had altogether 7370 acres, with a population of 8492: making a total for the three parishes of 11,080 acres, and 14,302 inhabitants in 1831, of whom 8468 were in the town itself.

The town of Truro is situated at the confluence of the Allen and Kenwyn (two small rivers, whose junction forms a stream, a furlong wide, flowing into the Carrick road): it occupies the point of land between the rivers, and some portions of the opposite banks. It is well built: the streets are partially paved and lighted under an act obtained A.D. 1790, and including in its operation all streets and passages in the old borough and half a mile beyond its boundary. St. Mary's Church is in the centre of the town: it is a handsome building of perpendicular character, with a spire of modern erection. Kenwyn Church is within the municipal boundary, but stands half a mile north-west of the town. There is a chapel-of-ease to Kenwyn in the town, and there are several places of worship for Protestant dissenters and for different classes of Methodists. There are assembly-rooms, which may be converted into a theatre; a county library; a literary society, called the Cornwall Institution; a county infirmary, and a small borough gaol.

The trade of Truro is considerable; and the town is the residence of several of the gentry of the county, and is in the centre of an important mining-district. Some tin is smelted, and tin and copper are exported: the manufacture of carpets was formerly carried on, but we know not whether it is continued. The imports are iron, coal, and timber. There are two weekly markets (Wednesday and Saturday), both well supplied with meat and fish and other provisions; the Wednesday market is also a corn-market. There are four yearly cattle-fairs. The Easter sessions for the county are held at Truro; and the court of the Vice-Warden of the Stannaries, which is a court of record, is held here also. Truro is one of the coinage towns for the coinage of the tin): the process is carried on only here and at Penzance.

The borough sent members to parliament in the reign of Edward I. The boundaries of the borough were enlarged for parliamentary purposes by the Boundary Act, considerable portions both of St. Clement's and Kenwyn parishes being added; and these enlarged boundaries have been adopted in the Municipal Reform Act for municipal purposes also: the borough thus enlarged is by the same act divided into two wards, and has six aldermen and eighteen councillors, with a commission of the peace. The number of parliamentary electors, in 1835-6, was 556; in 1839-40, it was 644: showing an increase of 88.

The living of St. Mary is a rectory of the clear yearly value of 135*l.*, with a glebe-house; that of Kenwyn is a vicarage (united with the vicarage of St. Kea), of the clear yearly value of 703*l.*, with a glebe-house; and that of St. Clement is a vicarage, the yearly value of which is not returned. All are in the rural deanery of Powdre, in the archdeaconry of Cornwall, and in the diocese of Exeter.

There were in the three parishes, in 1835, forty-nine day-schools of all kinds, with 1674 scholars, viz. 598 boys and 551 girls, and 525 children of sex not stated; one of these schools, with 45 children, was partly supported by an endowment and an allowance from the Earl of Falmouth, and one appears to have been a national school. There were also eleven Sunday-schools, containing 1027 scholars, viz. 522 boys and 505 girls.

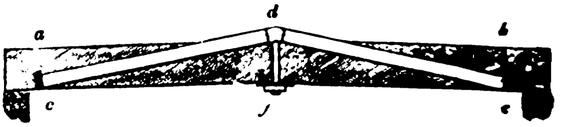
(Lysons's *Magna Britannica; Parliamentary Papers.*)

TRUSS. [HERNIA.]

TRUSSING. The principle of trussing, as applied to the timber framework of roofs, is explained under ROOF, vol. xx., pp. 144-147. It remains to notice some of the methods in which that principle is applied to the support or strengthening of beams or girders, which may, by its judicious application, be made available for much larger spans, and for the support of much greater weights, than simple beams of any practicable dimensions.

The rods or bars which are added to a girder for the purpose of trussing or supporting it may be applied in two sets, one on each side of the girder, and connected together by short cross-pieces at the necessary points; or the beam or girder itself may be divided longitudinally into two halves, or *flitches*, separated just so far as to admit a single truss between them, and held in the right position by the insertion of small blocks. In trussed girders formed in the latter way it is well to reverse the position of one of the flitches, so that the weaker end of one may lie alongside of the stronger end of the other. One of the simplest methods of trussing girders is that represented in *Fig.* 1, in which *a b* is the beam, resting upon walls or other fixed points of support at its extremities, and *c d* and *d e* are two inclined struts, resembling the rafters of a roof. These abut, at their lower extremities, *c* and *e*, upon iron plates inserted in the timber; and they sustain the centre of the beam by means of a *king-bolt*, *d f*, suspended from their apex, and passing through an iron plate which bears against the under side of the beam. This bolt corresponds with the king-post in the truss of a roof, and the lower part of the beam, between *c* and *e*, acts the part of a tie-beam.

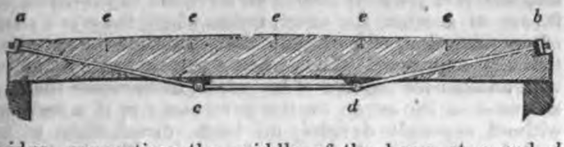
(*Fig.* 1.)



By screwing up the nut *f*, on the lower end of the king-bolt, the beam is *cambered*, or slightly curved upwards, as shown in the cut, and so long as it retains this curvature the weight laid upon it must eventually press upon the trussing-bars, being transmitted to them through the king-bolt. The defects of this mode of trussing consist in the circumstance that the beam will not, so long as it retains the cambered form, sustain any part of the load, but will of itself throw considerable strain on the truss; and that the lower edge of the beam, although required to be in a state of tension, to act as a tie connecting the abutments *c* and *e*, is really in a state of compression, because it forms the inner part of the curve, which is necessarily shorter than the outer line formed by the convex top of the beam. 'Notwithstanding these obvious defects,' observes Mr. Ainger in a communication to the Society of Arts (*Transactions*, vol. xlviii., p. 101), 'this mode of trussing continued to be much employed till about the year 1816, when Mr. Barlow, among other valuable experiments, compared girders trussed on the principle above described with a plain piece of timber of the same size, and found the latter to be on the average not considerably weaker.' These defects are remedied by connecting the lower ends of the inclined bars, which are, though not very properly, called braces, by an iron rod stretching in a perfectly straight line from *c* to *e*, and capable of being brought to any required degree of tension by means of screws or keys. This addition makes the truss perfect in principle, its strength being limited only by that of the materials employed, which may be either iron alone, or iron and wood. In some cases the inclined bars are not continued upwards until they meet in an apex, and a third bar, in an horizontal position, is placed between their upper ends. This horizontal piece resembles the straining-sill of a truncated roof [ROOF, *Fig.* 11, *h*], and the vertical bolts, of which two are used, take the place of queen-posts.

In the paper by Mr. Ainger above referred to, it is observed that trusses on the above principle are difficult and somewhat expensive to make in an effectual manner; and a more economical plan is described, which, though not equally efficient, adds very greatly to the strength of the timber. The description is illustrated by a representation, of which *Fig.* 2 is a copy, of a girder thirty-four feet long, used to support a leaden flat, and which had been found to stand without sensible alteration for two years. The beam *a b* is cambered in a similar degree to that shown in *Fig.* 1, and the trussing consists of a series of iron rods, *a c*, *c d*, and *d b*, pulling against iron plates or abutments notched into the timber at *a* and *b*, and connected together at the joints *c* and *d*, by bolts similar to those used in the chains of a suspension-bridge, the rods *c d* being double, and embracing the ends of *a c* and *d b* between them. The truss forms, in fact, a suspension-

(*Fig.* 2.)



bridge, supporting the middle of the beam at *c* and *d* by means of small blocks inserted between it and the connecting-bolts. The ends of the truss, *a* and *b*, are prevented from approaching each other by the upper part of the beam, which should therefore be in a state of compression; and in order that it may be so, notwithstanding the extension of the fibres by the cambering of the beam, notches may be cut about one-third through the substance of the wood, as at *e*, *e*, *e*, *e*, *e*, which, after the curving of the beam, are filled in with wedges of hard wood or iron. The upper edge of the beam is thus enabled effectually to resist the tension of the rods, the strength of which forms the only limit to that of the girder. Several varieties of this plan of suspension-trussing are given in Hebert's 'Engineer's and Mechanic's Encyclopædia,' vol. i., pp. 158-161. It may be applied, like the former system, either to single girders or to those consisting of two flitches. Ainger gives a formula for calculating the size of the iron trussing-rods, which, for a beam thirty-four feet long, should have a cross-section of rather more than a square inch for every ton weight to be sustained in the centre of the beam. It was found by experiment that a fir beam eight inches square and twelve feet long between the supports, strengthened by iron rods one inch square, applied as in *Fig.* 2, would support between 4000 and 5000 pounds, which is more than double the weight it would sustain without trussing. A girder of the same dimensions, trussed with iron braces on the principle of *Fig.* 1, but with the addition of an horizontal tie-bar one inch square, appeared to possess no greater strength to resist fracture, although its deflection under similar loads was less, owing to the iron braces being less compressible than the fir-wood, which, on the suspension principle, has to resist the tension of the rods.

The late Mr. George Smart, inventor of the ingenious truss called the 'bow-and-string rafter' [Roof, *fig.* 23], in experiments tried to ascertain how far the strength of a beam is increased by confining its ends, so as to prevent them from approaching each other when the centre is heavily loaded, found that a lath which, when simply laid on two points of support, broke with a load of 11 lbs. placed in the middle, would sustain 270 lbs. when the ends were firmly secured by wedges. These experiments led him to the construction of trussed beams of unusual lightness, in wrought-iron as well as in wood. In 1826 he submitted to the Society of Arts a wrought-iron beam adapted for use in bridges, roofs, floors, and other constructions in which stiffness, strength, and lightness are required, for the invention of which he was rewarded with their silver Vulcan medal. This beam or girder is made by welding the ends of an arched bar of wrought-iron to a longer straight bar, and then turning the ends of the straight bar either up or down, as may be most convenient for fixing, according to the particular use to which it is to be applied. Blocks of well-seasoned wood are then inserted at intervals between the arch and the straight bar, to prevent buckling, and the whole is held together by iron straps inclosing the blocks and the iron bars. Mr. Smart conceived that wrought-iron beams made in this way would support so much more weight than those of cast-iron of similar dimensions, that they might be made of any given strength for one-half the cost of cast-iron girders; and he refers to the application of such a beam to sustain a very heavy mass of brickwork over a gateway leading from the Poultry, under circumstances which would have precluded the use of timber. Very light timber beams were made by Mr. Smart upon the same principle; and so strong was his confidence in the application of trussing upon an extensive scale, that he published a design for a foot-bridge of trussed timber to cross the river Thames at Hungerford by a single span.

Cast-iron beams are frequently trussed with wrought-iron rods, in a similar manner to those of wood, and are applied to purposes for which great strength is required. The brest-summers used over large shop-windows, to sustain the front wall of the house, are often made in this way; and similar girders are much used in the construction of railway bridges. The bridge which supports the London and Blackwall Railway across the street called the Minories is a remarkable example. It has a clear span of sixty-three feet, and is supported by six massive trussed beams, weighing about fifteen tons each. When used in floors or roofing, timber may be applied on each side of the iron, supported by ledges formed for the purpose, to render the fitting of the joists and other timbers easy. Smart recommends the use of bridging and ceiling joists formed of wide hoop-iron riveted together, with a slip of poplar between them to hold the flooring or lath-nails; and he observed that neither fir nor oak will, when thin, receive nails near so well as poplar, without splitting: in addition to which he says that, besides being very durable if kept dry, it has the advantage of being much less combustible.

Trussing has been applied with advantage to the raising of sunken floors, and the repair of beams which, from sagging or from the ravages of dry-rot, have become dangerous. In the forty-second volume of the 'Transactions' of the Society of Arts, pp. 149-152, is an account of a method of raising a sunken floor, which had been successfully practiced by Mr. F. Richman, and for which he was rewarded with the large silver medal of the Society. The floor on which he had operated had sunk in the middle to the extent of five inches, and had become very tremulous, in consequence of the removal of a trussed partition, in order to throw two rooms into one. The ceiling and cornice of the room below being valuable, it was desirable to apply a remedy from above, which was accomplished by removing the floor, and applying to each side of the sagged beam a cast-iron arch, of which the span was equal to the length, and the height or spring equal to the depth, of the beam. The ends or abutments of these arches were united by tie-rods of wrought-iron. Four equidistant holes were then cut transversely through the beam near its lower edge, and in each of these was placed a short bar, having an eye projecting on each side of the beam. Through these eyes were passed vertical bars or trussing-bolts, which rose above the top of the beam, and were there connected together by cross-pieces, which rested upon blocks attached to the cast-iron arches. By screwing down nuts upon the upper ends of these bolts, as the arches themselves could not yield, the beam was compelled to rise, and was so restored to its original straightness. The cast-iron arches and their tie-rods were formed of several small pieces, so that they might be very conveniently applied; but for the method of accomplishing this, and for other matters of detail, we must refer to Mr. Richman's account, which is illustrated with engravings. In the same volume (pp. 153-164) is an account of the means adopted by Mr. Alfred Ainger for supporting the decayed timbers of the roof of the church of St. Mary Aldermary, in the city of London, by means of cast-iron trusses or cradles. This operation was performed under circumstances of unusual difficulty, some of the beams being so much decayed by the dry-rot as to have lost all bearing upon the walls. The ingenious contrivances adopted, which were rewarded by the Society of Arts with their large gold medal, prevented the necessity for destroying a richly-ornamented ceiling, the restoration of which would probably have cost 5000*l.*

TRUST AND TRUSTEE. A trust, which is in fact only a new name given to a use, is well defined by Lord Coke in the words employed by him for the definition of the latter term, viz.: 'A confidence reposed in some other, not issuing out of the land, but as a thing collateral, annexed in privity to the estate of the land, and to the person touching the land, for which *cestui que use* has no remedy but by *subpœna* in Chancery.' (Co. Litt., 272 b.) The explanation of the terms of the above definition, and an account of the origin of uses and trusts, and their connection with each other, will be found under Uses. The purpose of this article is to give a general account of the nature, constitution, and objects of trusts, of the duties and liabilities of trustees, and of the rights and estate of the *cestui que trusts*, that is, of the persons beneficially entitled under trusts.

The first division of trusts is into simple and special. The simple trust corresponds exactly with the antient use, and is where property is simply vested in one person for the benefit of another, the terms of the trust not being specified, but left to the construction of law. The special trust, on the other hand, is where property is vested in a trustee for purposes particularly pointed out, and where therefore he is not the simple depositary of the estate, but is bound, in his character of trustee, to the active performance of certain duties. Special trusts are further subdivided into ministerial and discretionary; the former being such as require for their performance only the ordinary qualities of a rational agent, the latter such as involve the exercise of more or less of judgment and discretion.

I. Of the creation of trusts.

1. And, first, as to trusts created by the act of a party.

A declaration of a trust is regarded in equity as a gift or conveyance of property to the persons who are the objects of the trust, and therefore the capacity to declare a trust is limited by the same rules as the power of disposing of property at law. Thus persons under the disabilities of coverture, infancy, lunacy, or idiotcy are incapable of creating trusts wherever they would be incapable of conveying at law.

By the common law, trusts might be created by parole, but by the seventh section of the Statute of Frauds (29 Car. II., c. 3) it was enacted that 'all declarations, or creations of trusts or confidences in any lands, tenements, or hereditaments, shall be manifested and proved by some writing, signed by the party who is by law enabled to declare such trust, or by his last will in writing, or else they shall be utterly void and of none effect.' The words 'lands, tenements, and hereditaments' in this clause can have no application to personal estate, trusts relating to which are therefore not affected by the statute; but they comprise chattels real (3 Ves., 696) and copyholds (Amb. 151). It is to be observed that the statute does not require trusts to be *declared* in writing, but only to be *manifested and proved* by writing; and therefore, though the language of the 9th section as to grants and assignments of trusts renders it probable that the intention of the act was that the declaration itself should be in writing, it is established that the statute is satisfied if the trust be manifested by any subsequent acknowledgment on the part of the trustee, however informal or indirect, as by a letter under his hand, his answer in Chancery, or by a recital in a deed, &c.; and though the writing itself must be signed, the terms of the trust may be collected from a paper not signed, provided it can be clearly connected with the signed writing. (3 Ves., 696; 2 Vern., 288; 2 P. W., 412.)

The enactments of the Statute of Frauds with respect to wills, as now modified by 1 Vict., c. 29, also indirectly affect the creation of trusts. As wills must be executed according to certain formalities, it follows that a trust of realty or personalty cannot be created by will without the observance of the proper solemnities; and it has been determined that, if the legal estate be effectually devised, but the declaration of trust be not duly attested, the devisee of the legal estate will be entitled to the beneficial interest (3 Atk., 141); though if there be *mala fides* on the part of the devisee or legatee, as if there be an express or implied undertaking to execute the intent, a court of equity will establish the trust notwithstanding the statute. (2 Vern., 559.)

A trust may be created either directly, by express declaration, or indirectly, without mention of a trust in words, by the expression of an intention, which the court of equity will execute as a trust.

In direct declarations of trust technical words are not necessary; but it is established as a general rule that, where they are employed, they are to be taken in their legal and technical sense. A distinction however is made in this respect between what are called trusts executive, in which the limitations are complete and final, and trusts executory, in which the expressed limitations are not intended as complete in themselves, but only as directions or instructions for a settlement to be afterwards executed. To the former the rule is strictly applicable, while with respect to the latter a court of equity will endeavour to execute what appears to be the intention of the parties, notwithstanding the use of inappropriate technical words; and the only difference in this respect between executory trusts in marriage articles and in wills is, that the known objects and purposes of the former afford a clue to the intention, which in the latter can in general be collected only from the language of the instrument. (Fearne, *Cont. Rem.*, 94, 114.)

When the owner, or the person otherwise entitled to the disposition of property, shows an intention to exercise it in favour of another, the court, unless where there is a want of consideration, will execute that intention, however informally expressed. Thus when a person has contracted with another for the sale of his estate, he becomes thereby a trustee of the estate for the purchaser; or if a testator, without expressly devising his lands, direct them to be sold for payment of debts and legacies, the lands will descend to the heir as a trustee for the creditors and legatees.

Trustees being considered merely as the instruments through which a trust is to be carried into execution, the Court of Chancery will not allow a trust to fall to the ground from the want of trustees, or their refusal to act, but will appoint proper persons to administer the trust.

In general all persons capable of acquiring the legal estate in property are capable of being trustees, and are bound by the trusts declared of it; though an exception should perhaps be made with respect to property vested in the king, against whom there is no remedy in Chancery, though the subject might sue the crown by preferring a petition of right. (Hardres, 467; 1 Ves., 446.) The fitness of a person for the office of trustee however depends on his capacity to discharge the discretionary part of the trust, and to join in the requisite assurances relating to the property: *femes covert* and infants, on account of the disabilities they labour under, are not proper persons to select for the office of trustees. An alien may discharge the office of trustee of personal chattels, though not of lands or chattels real, as he could not sue or be sued respecting such property; besides which, the legal estate of the property so conveyed to the alien would vest, on inquisition found, in the king. (Gilb. *On Uses*, 43; 2 Mer., 431.)

The manner in which settlements of property are affected by the question of consideration has already been explained. [SETTLEMENT.] When a trust is founded on a valuable consideration, it will of course be carried into execution, whether it was originally well-created or not: but where the trust is merely voluntary, the Court of Chancery will not interfere to give effect to an imperfect instrument; though when the trust is originally well-created no consideration is essential, and the Court will execute it, though voluntary. (18 Ves., 99, 140.)

The objects proposed by the trust must be conformable to the rules of law; for nothing will be permitted to be done under cover of a trust which could not be done by a direct legal conveyance. Thus the rules against perpetuities, those with respect to restraints on alienation, &c., are equally applicable to trusts and to legal estates; and if a trust of lands be declared in favour of an alien, the sovereign, on inquest found, will be entitled to the trust by forfeiture. (Hardres, 495.)

2. As to trusts created by operation of law.

Trusts of this kind may arise in three ways: 1st. Where the trust originally derives its existence from operation of law; 2ndly. Where a trust already in existence is revived by operation of law, as against a particular property; and 3rdly. Where a trust already in existence, and annexed to a particular subject-matter, arises *de novo* by operation of law as against a particular person.

Trusts of the first kind arise either where an estate is purchased in the name of one person, and the consideration is paid by another, in which case a trust of the legal estate arises for the person who advances the purchase-money; or where, upon a conveyance or will, the grantee, devisee, or legatee is intended to take the mere legal estate, and the beneficial interest is left wholly or partially undisposed of: in which case a trust of so much of the beneficial interest as is undisposed of results to the settlor or his heir, if the subject be real estate, and if it be personal estate, to himself or his personal representative. The intention to exclude the person to whom the legal estate is given from the beneficial interest may either be presumed from the circumstances or actually expressed upon the instrument. Whenever, upon a conveyance or will, a trust is declared of part of the estate, and no mention is made of the residue, the partial declaration is considered to have been the sole object of the settlor, and the remaining interest results to him or his representative. But if no trust be expressed of any part of the estate, the grantee or devisee must, in the absence of *mala fides* on his part, be considered as beneficially entitled to the whole. (2 Bro. *C. C.*, 589; 1 Ath., 448.) No general rule can be laid down as to when a gift will be considered as beneficial or as a trust; but the court proceeds in each case upon the probable intention of the settlor as derived from the general scope of the instrument. The presumption thus arising may be rebutted by positive parole evidence of the intention of the settlor. (2 Vern., 4, 53.) Again, a trust results, by operation of law, to the settlor or his representative, where the intention that the grantee, devisee, or legatee should not take beneficially appears upon the face of the instrument; as when the gift is expressed to be 'upon trust,' and no rust is afterwards declared, or upon trusts which cannot be carried into execution, either on account of their vagueness or as being against law. (18 Ves., 254; 1 Bro., C. C., 503.) The only exception to this rule is in the case of a gift either by deed or will for charitable purposes, where, if the objects of the trust are not specified, or do not exhaust the proceeds of the property, the ourt does not admit a resulting trust to the settlor or his epresentative, but takes upon itself to execute the inten- ion *cy-pres*, and to declare the purposes to which the fund hall be applied. (4 Bro., *C. C.*, 102; 1 J. & W., 319.) Vhen the trust results, not by presumption of law, but by he words of the instrument, parole evidence is not admis- ible to defeat it. (17 Ves., 442.) On the application of he doctrine of resulting trust to devisees, see Will.

A trust of the second kind arises when the estate is onverted by the trustee from one species of property to nother, either in pursuance or in breach of his duty. If he property in its original form was subject to a trust, the *estui que trust's* interests cannot be affected by any hange in that form. Thus where trust-money has been id out in the purchase of land, and where the rents and rofits of land have been laid out in the purchase of stock, he land and the stock have been held bound by the same quity to which the money laid out in the purchase was ubject. (8 Ves., 46; 1 Atk., 48.) In the same manner, a trustee or other person invested with a fiduciary cha- acter obtain a renewal of a lease in his own name and at is own expense, the trust which was annexed to the ori- inal term will attach upon the renewed lease, and the ustee will be entitled only to the amount of expense in- urred. (11 Ves., 391; 1 Eden, 453.)

The third kind of trust by operation of law arises herever the property passes from the trustee into the ands of a person who takes by a derivative title. The eir, devisee, or personal representative of a deceased trus- ee takes the property in the same character, and is bound y the same equity. Where the trust estate has passed to stranger by conveyance, if he be a volunteer, that is to y, if there was no proper consideration for the conveyance, e will be bound by the trust, whether he had notice of it -not. (2 P. W., 678.) If however the grantee was the urchaser of the estate for an adequate consideration, then, he took with notice of the trust, he will be bound by it, the same manner as the person from whom he purchased; ut a *bonâ fide* purchaser, without notice of the trust, is ot affected by it; and his title, even in equity, cannot be mpeached. (15 Ves., 350; 2 B. & B., 318.)

By the 8th section of the Statute of Frauds it is enacted at 'where any conveyance shall be made of any lands or nements by which a trust or confidence shall or may ise or result by the implication or construction of law, or transferred or extinguished by act or operation of law, ien and in every such case such trust or confidence shall e of the like force and effect as the same would have een if that statute had not been made, anything therein- efore contained to the contrary notwithstanding.' This xception appears to have been introduced into the sta- ute in order that the extent of the enactment might ot be left to implication; for as resulting trusts depend, ot upon the instrument, but on the effect of a rule of law, is not easy to see how they could be affected by the pre- ious enactment, which refers to trusts created by the nstrument.

It has been doubted whether, where a purchase was made in the name of a stranger, and the payment of the onsideration-money by the real purchaser did not appear pon the instrument, parole evidence could, since the Sta- ute of Frauds, be admitted in proof of the fact; but as rusts by operation of law are expressly excepted from the tatute, it seems clear upon principle that parole evidence hould be admissible, and probably it would now be so held. (10 Ves., 517; but see Sanders, *On Uses and Trusts*, c. 3, sec. 7, div. 2.)

II. Of the estate and office of trustees.

1. Of their estate.

Whenever a trust is created, it is a general rule that a legal estate, sufficient for the purposes of the trust, shall, if possible, be implied; and also that the legal estate limited to trustees shall not be construed to extend beyond what the purposes of the trust require. Thus the court has in many cases extended the estate, so as to make it commensurate with the objects to be effected, and even supplied the estate when it was altogether wanting. (1 Ves., 495.) On the other hand, the court has frequently restricted the estate which trustees would have taken by the wording of the instrument. (7 *T. R.*, 433.) But these rules, so far as they relate to devises, must now be considered with reference to the 1 Vict., c. 26, by the 30th section of which it is declared that where any real estate, other than a presentation to a church, is devised to a trustee or executor, such devise shall be construed to pass the whole estate which the testator had power to dispose of in the property, unless a definite term of years, absolute or determinable, or an estate of freehold, be thereby given to him expressly or by implication.

The legal estate vested in a trustee has in general the same properties and incidents as if the trustee were the beneficial owner. Thus it is liable to curtesy, dower, and free-bench, and at the common law it was subject to forfeiture to the king and escheat to the lord; but the law is now altered by the 4 & 5 Wm. IV., c. 23, ss. 2 & 3, whereby, when a person dies seised of land as trustee or mortgagee, without an heir, the Court of Chancery may appoint a person to convey; and it is declared that the devolution of such estates is not to be by the attainder or conviction of the trustee or mortgagee. The legal estate in the property, whether real or personal, may be conveyed or assigned by the trustee, who may likewise devise or bequeath it by his will, though trust-estates will not always pass in a will by the same words as other property, and the question in each case is one of presumed intention. (8 Ves., 417.) But trust-estates, whether real or personal, do not vest in assignees upon the bankruptcy of the trustee (Willes, 402; 1 M. & S., 517); and the enactments of the Insolvent Acts (7 Geo. IV., c. 57, and 1 & 2 Vict., 110) must, it seems, be governed by the same rule. Judgments and executions for debt affect trust as well as other property, but of course the creditor availing himself of them becomes himself a trustee by construction of equity. (1 Bro., *C. C.*, 278; 1 P. W., 277.)

2. Of the general properties of the office of trustees.

Acceptance of the office by a trustee may either be by express declaration, or be implied from his proceeding to perform the duties of it. No general rule can be laid down as to what particular acts will constitute an acceptance of the office by a trustee, which is a question to be determined by the circumstances of the particular case: it may however be stated generally that every voluntary interference with the trust-estate will be construed as an acceptance of the trust; and that where a trustee acts ambiguously, he will not be allowed afterwards to take advantage of the doubt, and deny that he acted in the character of trustee. (2 Ves., j. 678; 1 Ves., 552.)

But as no one is compellable to undertake a trust, it is in the power of the person appointed a trustee to renounce the office by what is called a disclaimer, which, if he intend to decline the office, he ought to execute without delay. A disclaimer ought to be made by deed, and should purport to be a disclaimer, and not a conveyance, which, as it transmits the estate, would, strictly speaking, imply a previous acceptance of the trust, though instruments of this kind receive a liberal construction. (2 Swanst., 372; 2 M. & K., 278.) An intention to disclaim may also be inferred from the conduct of the trustee (1 M. & K., 195), though it would be very imprudent for any one to leave the question of his acceptance or renunciation of a trust to be matter of construction. As to what amounts to a disclaimer of the estate at law, which is a very distinct question from the disclaimer of the office in equity, see Disclaimer. The effect of a disclaimer by one trustee is to vest all the powers of the office in the co-trustees who accept the trust. (5 Mad., 435.)

The general properties and qualities of the trustee's office may be stated under the following heads:—

(1.) A trustee having once accepted his office cannot afterwards renounce it. The only modes by which he can be released are a decree of a court of equity, a power reserved on the instrument creating the trust, or the consent of all the persons beneficially interested in the estate. (2 Sch. and Lef., 245.)

(2.) The office of trustee, which implies personal confidence, cannot be delegated (2 Ves., 640), though a trustee may sometimes perform a mere ministerial duty through an attorney or proxy. (1 Ves., 413.)

(3.) When there are several trustees, the administration of the estate is vested in all; and therefore if one refuse to act, the others cannot proceed without his concurrence, and the Court of Chancery must take upon itself the administration of the trust. (2 *Eq. Ca. Ab.*, 742.)

(4.) Where one of several trustees dies, the joint office may be exercised by the survivors. This is a consequence of the general maxim of law, that though a bare authority given to several determines by the death of one, if the authority be coupled with an interest it survives. (Co. Litt., 113 a, 181 b.)

(5.) One trustee is not liable for the acts of his co-trustee in which he has not joined, and this is equally true whether there is a proviso to that effect in the settlement or not. (Bridg., 35; 18 Ves., 254.) And even if a trustee joins in a receipt for money required for the purposes of the trust, for the sake of conformity only, he will not thereby become responsible for the application of it, though it will be upon him to prove that his co-trustee was the person by whom the money was received. (11 Ves., [illegible]24; 1 Ed., 147.) The rule is different with respect to co-executors, each of whom has an absolute control over the property, and who are therefore under no obligation to join in giving receipts (Amb., 219; 3 Swanst., 64); though whenever their joining together in doing any act is necessary, the same rule applies to them as to other trustees. (7 Ves., 197.) But if a trustee allows money to remain improperly in the hands of his co-trustee, or is cognisant of a breach of trust committed by him, and takes no measures to protect the estate, he will become himself responsible. (11 Ves., 319.)

(6.) Trustees cannot derive any private advantage from the administration of the trust, and therefore all profits made by the trustee in the management of the trust estate, in whatever manner, belong not to him, but to the *cestui que trust*. (2 M. & K., 664.)

III. Of the duties of trustees.

Trustees of personal estate are bound to use all due diligence in getting in and reducing into possession all parts of the trust estate that may happen to be outstanding at the time of the commencement of the trust (1 Mad., 290), and in providing for the safe custody of the property. (1 Ed., 148.) They are also bound, where trust-money cannot be applied immediately, to invest it on proper security, so as to render it productive to the *cestui que trust*. In the absence of any specific direction as to investment in the trust-deed, the rule is that the trustees ought to invest in the public funds. They cannot lend on personal security, or invest the money in the stock of any company, or on mortgage, without express authority. (1 Cox, 25; 7 Ves., 150; Jac., 234.) And even where they are empowered to lend on real security, they should not advance more than two-thirds of the value of the estate. (M. & C., 8.)

Where a trust-estate consists of renewable leaseholds, it is in general the duty of the trustee to provide for renewals. If there be an express trust to provide for the fines out of the rents and profits, the trustees should lay aside a proper proportion of the annual income for the purpose. (17 Ves., 485.) If there be no express direction for payment of the fines, the estate may be charged with the amount of the fine, and the rule of the court is that the tenant for life and remainder-man must apportion the fine between them according to the value of their respective interests. (1 Bro., *C. C.*, 440; 9 Ves., 560.)

Trustees, to preserve contingent remainders, are bound, until the eldest son of the settlement attains twenty-one, not to do any act to destroy the contingent remainders; and if they commit a breach of trust, they will be liable to make compensation to the persons claiming as purchasers under the settlement. (1 *Eq. Ca. Ab.*, 385.) After the eldest son attained twenty-one, the trustees, to preserve contingent remainders, were formerly considered to have a discretion in joining or not in the destruction of the remainders; and it was a question whether they were in any case answerable for the exercise of that discretion (1 V. & B., [illegible]); but the law upon this point must now be considered with reference to the 3 & 4 Wm. IV., c. 74, under which a bare trustee cannot, as regards settlements made since the passing of the act, be protector in any case; and with respect to settlements made before the passing of the act, though he may continue protector, he is not answerable in that character to a court of equity for the exercise of his discretion.

Trustees for sale, whether expressly such or by implication, have, in the absence of any express restriction on their powers, the right to use all reasonable discretion as to the time and manner of effecting a sale. They cannot be compelled to enter into any other covenant than that against incumbrances by their own acts. As to the cases in which, in the absence of any express provision, their receipts will be discharges to a purchaser, see Sugden, *Vend. and Purch.*, c. xi., s. 1. The general rule is, that a trustee for sale cannot become the purchaser of the trust property either for himself or as agent for another; and the *cestui que trust* is at liberty to set aside any such purchase, however fair, and though no advantage should have been gained by the trustee. (3 Ves., 750.) But a trustee is not absolutely prohibited from purchasing from the *cestui que trust* under certain circumstances, though the transaction is at all times one of great difficulty, and looked upon with great suspicion by the court. (9 Ves., 244.) Upon setting aside a purchase by a trustee, the court will in general allow for all repairs and improvements effected on the property. (11 Ves., 226.) The *cestui que trust* will not be entitled to relief unless he make his application within a reasonable time; and if while *sui juris*, and with full knowledge of his rights he expressly confirms the purchase, he will not be allowed afterwards to set it aside. (5 Ves., 680; 12 Ves., 355.)

Charities are either such as are managed by individual trustees or established by charter as eleemosynary corporations. Charitable trusts of the first kind are, like any other trusts, subject in all respects to the jurisdiction of the Court of Chancery; but where charities are established by charter, a visitorial power over the governing body arises of common right in the founder and his heirs, unless where he has specially nominated other persons to that office. The Court of Chancery has nothing to do with this visitorial power, though when the king is the visitor, or the heir of the founder cannot be found, or is lunatic, the visitorial power is exercised by the chancellor as keeper of the great seal. The court of equity however assumes a jurisdiction with respect to the administration of the property of charitable corporations, the governing bodies of which are, with respect to their management of such property, subject and accountable to the court. It is the general duty of the trustees of a charity, whether individuals or a corporation, to confine the application of the funds strictly to the purposes declared by the founder or donor; and they should never assume the responsibility of in any manner overstepping such purposes, however necessary or advisable such a course may seem, without the sanction of the court; which, though it cannot divert the charity funds into a totally different channel without the authority of an act of parliament, has sometimes extended the application of them to purposes beyond the strict intention, but closely connected with it. (3 Russ., 530.) Trustees of charities have no power to make an absolute disposition of the charity estates, though when it appeared to be for the advantage of the charity, the court has sometimes granted them authority to do so. (2 Swanst., 300.) Nor can they accomplish the same end indirectly by granting long or unreasonable leases (2 Russ., 306); but they may exercise a reasonable discretion in the management of the estates, as well as in establishing rules for the government of the charity.

IV. Of the powers of trustees.

The powers of trustees are either *general* or *special*. It is impossible to define exactly the general powers of trustees, the extent of which depends in each case upon the particular circumstances of the trust-estate. It may however be laid down as a general rule, that whatever is compellable by suit is equally valid if done by the trustee without suit (4 Ves., 369); though, if a suit has already been instituted for the execution of the trust, whereby the management is taken out of the hands of the trustee, he ought to take no step without the sanction of the court. (10 Ves., 104.) As to the different kinds of special powers, see USES. Questions frequently arise upon powers given to trustees, depending upon the manner in which they are limited. If an estate be limited to trustees and their heirs, it vests absolutely in them and the survivors or survivor of them; but the words are not to be understood to the same extent in the limitation of a mere legal power. The power is not assignable or devisable, and can be exercised only so long as the circumstances of the trust correspond to the words of the limitation. Thus a power to executors may be exercised by the survivors only so long as the plural number remains, and a power to four trustees and the survivors of them cannot, it seems, be exercised by a single survivor: but a power given to executors, if annexed to the executorship, will continue to the single survivor; and so, it seems, will a power given to trustees, and annexed to their office, as where an estate is vested in them, and a power is conferred relative to the trust. This construction arises from the trust being coupled with an interest, which continues in the survivor. (Sugd., *Powers*, c. 3, § 2.) And inasmuch as a power, though not coupled with an estate, is, when imperative, considered as a trust, and will equally be carried into execution by a court of equity, it may be concluded that a power of this kind may also be executed by the survivor.

If a power be given to co-trustees, and one of them disclaim, it seems the power may be exercised by the continuing trustees (4 Ves., 97); but if the trustee assigns the estate, the power, not being appendant to the estate, will not become thereby transferred to the grantee; nor, where it is of such a kind as that it may be exercised by a person not in possession of the estate, will the assignment withdraw it from the grantor. (Amb., 309.)

The special as well as the general powers of trustees are affected by the institution of a suit, so that they cannot be afterwards exercised without the sanction of the court.

V. Of allowances to trustees.

It is a settled rule that a trustee is not entitled to charge for his time and trouble in the management of the trust-estate, whether he be a professional person or not; and the rule applies not only to trustees expressly nominated, but to all persons bearing a fiduciary character, such as executors, mortgagees, receivers, and committees of lunatics' estates. (10 Ves., 103.) Exceptions to this rule have been admitted in the cases of trustees for the estates of absentees in the West Indies and executors in India; but the rule against such allowances to trustees is only a general one in the absence of express directions by the settlor to the contrary, and there is no objection to a trustee's receiving remuneration for his services, or to his being allowed to make professional charges, if the intention of the settler to that effect be clearly expressed. (7 Ves., 480; 3 Beav., 338.) A trustee may even bargain with his *cestuis que trust* for an allowance, though bargains of this kind are very narrowly watched by the court. Trustees not being allowed to charge for their own trouble may, on proper occasions, and where the business of the trust is troublesome or complicated, call in the assistance of agents at the expense of the estate.

A trustee, though not allowed to charge for his trouble, is entitled to all his expenses out of pocket; and even a specific remuneration given by the settlor to the trustees is no reason for their not receiving an allowance for expenses. (7 Ves., 480.) The expenses incurred by a trustee in the management of the trust-estate are considered as a charge upon the estate, to the satisfaction of which the trustee is entitled before he can be compelled to convey.

The general rule with respect to the costs of trustees incurred in legal proceedings is, that they shall be allowed as between solicitor and client, if there be a fund under the control of the court out of which they may be paid. (1 Swanst., 201.) But this rule is subject to numerous exceptions, depending upon the circumstances of the case, and the propriety or otherwise of the conduct of the trustee, either in the course of the suit itself or in the matters out of which it arose. A trustee who disclaims by answer in chancery is entitled to costs as between party and party only. (2 M. & K., 278.)

VI. Of the relinquishment of office by trustees.

A trustee may be discharged from his office by the consent of the *cestuis que trust*, but for this purpose the consent of all must be obtained, however numerous they may be; and if any of the *cestuis que trust* be incompetent to consent, or be not yet *in esse*, as in the case of a limitation to unborn children, no complete discharge can be obtained.

A trustee may be discharged in virtue of a special clause to that effect contained in the instrument under which he is trustee. A proviso to this effect is usually introduced into settlements combined with a power either to the *cestui que trust*, or to the co-trustees, to nominate a new trustee in the event of any of the number happening to die, or being desirous of being discharged from, or refusing or declining, or becoming incapable of acting in the trusts. The transfer of the trust is not complete until the new trustee has been nominated by the donee of the power, and a conveyance or assignment of the property has been executed. When the trust-estate consists of funded property, a transfer of it is effected into the names of the continuing and new trustees, and then the appointment by the donee of the power, and a declaration of trust by the old and new trustees, is made by one deed. But when the property consists of any chattels real or personal other than stock, two deeds are necessary, one whereby the property is assigned by the old trustees to a provisional trustee, and another, generally endorsed on the former, whereby the provisional trustee re-assigns it to the continuing and new trustees upon the trusts of the settlement. When the estate is freehold, the object is in general effected by a single conveyance operating under the statute of uses, made by the old trustees to the use of the continuing and new trustees upon the trusts of the settlement. But where the settlement confers powers upon the trustees, and does not invest them with the fee-simple, but only with some particular estate, such as an estate to preserve contingent remainders, though the meaning of the words used in the common form of a power to appoint new trustees plainly is that every new trustee should have the same powers as the old trustee had, it has become usual to consider it essential that the new trustees should have a seisin to serve the uses in the same manner as the old trustees had. For this purpose two deeds are necessary: one whereby the new trustee is nominated, the whole uses of the settlement are revoked, under a power supposed to be implied for that purpose, and the use and estate appointed and conveyed to a stranger in fee; and another (which may be indorsed on the former) whereby the stranger re-conveys to the uses of the settlement. Thus, whether the power of revocation supposed to be implied exists or not, the estates are effectually vested in the old and new trustees by the actual conveyance. Powers of appointing new trustees are strictly construed, and cannot be properly exercised except under the precise circumstances contemplated in the power, and it is always considered that the original number of trustees ought to be maintained. For this reason it would be improper to appoint one trustee to do the duty of two retiring trustees (2 M & K., 682); and where there is a direction that upon the trustees being reduced to a certain number others should be nominated by the survivors, it has been determined that they might supply vacancies before the numbers were so far reduced, but that then they were compellable to do so. (5 Ves., 825.)

A trustee may get himself discharged from his office at any time by application to the Court of Chancery, by petition if there be a suit already pending, and if not, by bill. (1 J. & W., 251; Lloyd & Gould, 22.) A new trustee may be appointed under the 11 Geo. IV. & 1 Wm. IV., c. 69, s. 22, by petition in the cases mentioned in the act, where a conveyance or transfer could not otherwise be obtained.

VII. Of the estate and rights of the *cestui que trust*.

1. As to what it consists of. In cases of the simple trust the whole rights of equitable ownership consist in the right of possession and the right of disposition, or, as they are technically called, the *jus habendi* and *jus disponendi*.

The equitable owner has in general a right to the possession of the estate, but where there are several parties interested either contemporaneously or in succession, it is in the discretion of the court of equity to determine whether possession ought to remain with the trustee or be given up to the *cestui que trust*. The right of possession of the *cestui que trust* is recognised in a court of equity only, for at law the trustee is considered as the owner, and the *cestui que trust* as tenant at will only. The trustee as tenant of the legal estate may recover in ejectment from his own *cestui que trust*, who has no defence to the action at law, and is only entitled to apply for an injunction in equity. (8 T. R., 122; 1 B. & B., 445.)

Upon the ground that the *cestui que trust* is the beneficial owner of the estate, he is entitled, either by the express language or by the equitable construction of statutes, to various privileges connected with real estate. Thus the 2 Hen. V., st. 2, c. 3, and the subsequent statutes relating to persons entitled to serve as jurors, have been construed to apply to the *cestui que trust*, and not to the trustee. By 7 & 8 Wm. III., c. 25, s. 7, the right of voting as a freeholder of a county was conferred on the *cestui que trust*, if in possession; and by the 2 Wm. IV., c. 45, s. 19, the *cestui que trust* of copyholds or of any lands whatever except freehold, of the required yearly value, is entitled to vote at elections of members of parliament whether in possession or not. So also, by 9 Anne, c. 5, an equitable estate forms a qualification for sitting in the House of Commons.

The *cestui que trust* of chattels is also entitled to the use and possession of them during the continuance of his interest; and upon this ground they do not, upon the bankruptcy of the tenant for life, fall under the rules as to goods in the order and disposition of the bankrupt with the consent of the true owner. (19 Ves., 491.)

A *cestui que trust* who is entitled to the whole equitable interest may, in virtue of the *jus disponendi*, call upon the trustee for a conveyance of the estate. But he has no such right when the trustee holds upon trust for the benefit of others, or even when he is entitled to the whole usufructuary interest, but the continuance of the estate in the trustee is necessary to answer some ulterior purpose relating to the trust, such as to preserve contingent remainders. (5 Mad., 429.) It sometimes happens that the *cestui que trust* is entitled to call for a conveyance, but from the disability of the trustee, or from some other accidental circumstance, it cannot be obtained by the ordinary means. Various acts have at different times been passed to remedy this inconvenience, the provisions of which have been extended and consolidated under the 11 Geo. IV., & 1 Wm. IV., c. 60.

In cases of special trust, the right of the *cestui que trust* is to have a specific execution of the intention of the settlor to the extent of that *cestui que trust's* interest. If there be but one *cestui que trust*, and he capable of consent, the specific execution of the trust may be departed from; and so where there are several *cestuis que trust*, who all agree; but no variation can be made so as to affect the interests of any *cestui que trust* without his consent.

2. Of the nature and properties of the estate of the *cestui que trust*.

Equitable interests may be assigned, and the assignee may, like the original *cestui que trust*, compel a conveyance from the trustee by bill in equity, without making the assignor a party. (3 Russ., 583.)

Femes covert entitled to equitable interests in lands and equitable tenants in tail, might, before the Fines and Recoveries Act (3 & 4 Wm. IV., c. 74), have passed their equitable estates by those assurances, and may now do so under that act by the same modes of assurance and with the same formalities as if the estates were legal.

The purchaser of an equitable interest should take care to inquire of the trustee whether he has had notice of any prior incumbrance upon the equity of the vendor, which will give the purchaser a remedy against the trustee in case of his misrepresentation (10 Ves., 470); and the purchaser should also, upon the execution of the conveyance, give notice to the trustee of his own equitable title, whereby he will secure precedence of all prior incumbrances who have not given such notice. (3 Russ., 30.)

Equitable interests in property are transmissible by devise, and require the same solemnities as legal interests. (1 Vict., c. 26, s. 3.) Possession or receipt of the rents and profits of equitable estates is considered in equity equivalent to seisin at law, and adverse possession of the one is attended with the same effects on the title as disseisin of the other. (2 J. & W., 1, 153.)

A trust of freeholds or copyholds is subject to the courtesy of the husband, but was until lately exempt from dower and freebench: now however, by the 3 & 4 Wm. IV., c. 105, the title of dower attaches upon equitable in the same manner as upon legal estates, though subject in either case to be defeated by the alienation, devise, or other declaration of intention on the part of the husband.

The effect of marriage is the same upon equitable as upon legal interests, and therefore a husband may assign the trust of a term of years belonging to his wife, in the same manner that he may assign her chattels real at law. (9 Ves., 99.)

Judgment creditors have, by the Statute of Frauds, sec. 10, execution at law against the equitable freehold estate of a debtor in the hands of his trustee, when the debtor has the whole beneficial interest; but if he have a partial interest only, or the estate be not freehold, the judgment creditor has no execution at law, but he may in a court of equity obtain the same satisfaction out of the beneficial interest as he would be entitled to at law out of a legal estate. (4 Mad., 504.)

The equitable interest of the *cestui que trust* in lands is liable to extents from the crown; and though not forfeitable at common law for attainder of treason or felony, it appears to be clearly within the scope of the 33 Hen. VIII., c. 20, s. 2, which gives the same effect to attainders by common law or statute as to attainders by authority of parliament, but it is not subject to escheat. (Hardres, 465; Freem., 130.) The same statute appears to include equities of redemption. Trusts of chattels, whether real or personal, are subject to forfeiture. (Ibid.)

The estate of the *cestui que trust* is governed as to descent by the rules of the common law.

Trusts of chattel interests were always considered as assets in equity, but it was a question whether a trust of a freehold was assets in the hands of the heir until the Statute of Frauds, by the 10th section of which a trust in fee-simple was declared to be assets by descent, in the same manner as a legal estate. The enactment however applies to simple trusts only, and not to special trusts or equities of redemption (2 Atk., 293); but now, by the 3 & 4 Wm. IV., c. 104, all a person's *estate or interest* in lands, tenements, or hereditaments, corporeal or incorporeal, or other real estate, whether 'freehold, customaryhold, or copyhold' (which words apply equally to legal and equitable estates'), are made assets for the payment of debts as well by simple contract as on specialty. Trusts of chattel interests will be legal assets in the hands of the executor. (Mod., 556; 4 Ves., 541.) Simple trusts of real estate are made legal assets by the above-mentioned section of the Statute of Frauds; and it seems that complicated trusts and equities of redemption, which are not within the statute, will be considered legal assets as to specialty creditors by analogy to law. (2 *Ch. Rep.*, 143.) It appears that under the 3 & 4 Wm. IV., c. 104, real estates are, with respect to simple contract debts, to be taken as equitable assets, but that the act does not alter the mode of administration of trusts of chattels nor of equitable freehold interests, in so far as they were assets before the act.

3. It is a maxim of equity that a trust shall not fail for want of a trustee. If the intention of the settlor be clear, but he has omitted to name a trustee, or the trustee dies or becomes incapable of taking the estate, the trust attaches upon the person on whom the legal estate has devolved. (Wilm., 21, 22.) When powers given to trustees are not discretionary, but imperative, they are, as above mentioned, considered as trusts, and the court will protect the *cestui que trust* from the failure or neglect of the donee of the power. Where the discretion of the trustee was to be governed by a rule which the court can apply, it will do so; but where there is no rule or measure by which the discretion of the trustee was to be governed, the court executes the power in the manner which appears most reasonable, and in general proceeds upon the principle that equality is equity. (2 Ed., 332; *Eq. Ca. Ab.*, 194.) Where a discretion is given to the trustee in respect of the objects to whom an appointment is to be made, questions sometimes arise, when the power comes to be executed by the court, as to the objects to be included and the mode of distribution. When the power is in favour of 'relations,' the court, except under particular circumstances, appoints to relations within the statute of distributions, when it seems that the distribution will be made *per capita*, and not *per stirpes* (1 Bro., *C. C.*, 33); and the words 'next of kin' occurring in such a power are settled to mean 'nearest of kin,' to the exclusion of those

who would take by representation under the statute. (2 M. & K., 780.)

4. The *cestui que trust* is entitled to have the administration of the trust-estate placed in proper hands. Thus the court will dismiss a trustee upon its being shown, upon application by bill to the Court of Chancery, that he has acted improperly, or has become incapable of executing his office (4 Ves., 592; 5 Ves., 707); and where the original number of trustees has been diminished, the *cestui que trust* may have the vacancies supplied. (5 Ves., 772.) The *cestui que trust* may also file a bill against his trustee, either for the purpose of compelling him to the execution of an act of duty, or to restrain him from doing any act not within the scope of the trust, or which would be prejudicial to the estate. (1 Bro., *C. C.*, 177; 6 Mad., 10.)

5. If a trustee aliens the trust-estate, the *cestui que trust* may follow the estate into the hands of any person who has acquired it, whether he had notice of the trust or not; and even into the hands of a purchaser for valuable consideration, if he had notice at the time of his purchase. As to the limit of time and extent within which the *cestui que trust* may institute proceedings for the recovery of his estate, see Statutes of Limitation.

In case of a breach of duty by the trustee, the *cestui que trust* has also a remedy against him personally by way of compensation. The amount of the loss is considered as a simple contract debt against the estate of the trustee, and payment of it may be enforced in the same manner as for any other similar debt. The circumstance of the trustee having derived advantage or not from the breach of trust, makes no difference as to his liability. Where trustees are jointly implicated, it was formerly thought that the *cestui que trust* might proceed against any of them singly; but the contrary has since been settled. (8 Sim., 219.) But the *cestui que trust* will not be entitled to any remedy against his trustee, if he himself, being under no legal incapacity, has concurred in the breach of trust, or subsequently acquiesced in it, or *à fortiori* if he has executed a formal release to the trustee. (3 Swanst., 64.)

In cases of breach of trust by trustees of charities, the ordinary mode of redress is by way of information in Chancery, in the name of the attorney-general, in which some other person must be joined as relator to be answerable for costs. By the 52 Geo. III., c. 101, commonly called Sir Samuel Romilly's Act, a summary remedy is provided in cases of abuse of charitable trusts, enabling the parties to proceed by petition. The 11 Geo. IV. and 1 Wm. IV., c. 60, extends to all cases in which the court is authorised to make summary orders in cases of charities (sect. 21). The Statutes of Limitation do not apply to charities, and therefore there is no limit to the extent to which an account may be carried back against trustees of charities, except such as have been established by the practice of the Court of Chancery on grounds of convenience or otherwise; but where the misapplication of charity funds has been unintentional, it is settled that the account will not be carried back beyond the filing of the information, or of notice to the trustees of the intention to dispute the application. (Jac. 448; 2 Russ., 45.)

VIII. There are two rules of equity with respect to trust-estates which are of very general application. The first is, that what the settlor has directed to be done shall be considered as done; so that it shall not be in the power of trustees, by neglecting the performance of their duty, to affect in any way the interests of the *cestuis que trust.* Thus where money is directed to be laid out in land, or land is directed to be sold, equity will consider the conversion to have taken place, and deal with the property accordingly. This constructive conversion however subsists only until a *cestui que trust*, competent both from interest and personal capacity to elect, declares his intention as to the character in which he will take the property. [Election.]

The second rule, which is almost a consequence of the first, is, that no act of the trustee shall alter the nature of the *cestui que trust's* estate. This rule, of course, is to be understood only of acts not authorised by the trust; and with respect to *cestuis que trust*, who are *sui juris* is universal, but is subject to some exceptions with respect to trust-estates belonging to lunatics. The court, though it will not in general alter the condition of the lunatic's property to the prejudice of his representatives, will not refuse to do so if it appear to be clearly for the benefit of the lunatic himself. (2 Ves., jun. 72.) It was formerly thought that the court might exercise a similar discretion with respect to the estates of infants, but it is now settled otherwise. (10 Ves., 122.)

(Sanders, *On Uses and Trusts*; Lewin's *Law of Trusts and Trustees.*)

TRUXILLO. [Peru.]

TRYPHIODO'RUS (Τρυφιόδωρος), a Greek grammarian and a poet, who was a native of Egypt, and appears to have lived in the sixth century of our æra, about the reign of the emperor Anastasius. Particulars about his life are not known. We possess by him an epic poem of 681 verses, on the destruction of Troy, which bears the title Ἰλίου ἅλωσις (Excidium Trojæ). The narrative of this poem is exceedingly dull, and so much like a mere chronicle of events, that some critics have thought the work to be only a sketch or outline drawn up by the author with the intention of working it out into a longer poem. But there is no reason for thinking that the author was capable of doing much better things. This poem was first published, together with the works of Q. Smyrnaeus and Coluthus, by Aldus, at Venice, without date. The best modern editions are those of J. Merrick, Oxford, 1741, 8vo., which contains a Latin translation in verse, by N. Frischlinus, and notes by various commentators; of Th. Northmore, London, 1791, 8vo.; and, lastly, that of F. A. Wernicke, Leipzig, 1819, 8vo. This is the best critical edition, and contains most of the notes of former editors.

Besides this poem, which is the only work of Tryphiodorus now extant, he wrote various others, such as on the 'Battle of Marathon' (Μαραθωνιακά), on the 'Story of Hippodameia,' and on the 'Sufferings of Odysseus.' This last poem, which is called Ὀδύσσεια λειπογράμματος, is a strange specimen of the low state of poetical taste at that time. The author, according to Eustathius (*Ad Odysss.*, p. 1379), contrived to compose this poem without making use of the letter *s*. (Compare Suidas, *s. v.* Τρυφιόδωρος.)

TSCHERKASK, OLD (*Staraią Tscherkalzk*), the former capital of the country of the Don Cossacks, is situated in 47° 27′ N. lat. and 39° 58′ E. long., in a large but very low island formed by the Don and the Aksai (a branch of the Don), over which there are floating bridges. It is traversed by canals, and consists of an irregular mass of houses. On both sides of the canals there are wooden houses built on piles. The town is subject to frequent inundations, and in spring the communication between the houses must be by boats, the ground-floor being generally under water from April to June; the marshes and pools that remain during the summer occasion many diseases. It is probable that this otherwise ineligible situation was chosen from the difficulty of approaching it at a time when the country was constantly exposed to the sudden attacks of the Tartars. The town is surrounded with a strong rampart. Of the six churches the largest has a great treasure of jewels, gold, and silver taken in war. According to Clarke, there were, when he visited it, 15,000 inhabitants, almost all Cossacks, and some Tartars, Greeks, and Armenians. In consequence of the many disadvantages of this site, it was resolved, towards the commencement of this century, to remove to another spot. It appears that a beginning was made in 1805, but the Cossacks were so unwilling to leave the old town, that it was not till after the peace of 1814 that much was done towards the building of the new place.

TSCHERKASK, NEW (Novo), is situated at the distance of about four miles from the old town, on a dry elevated spot. Cannabich states that, in 1836, the building had not made so much progress as might be expected, the Cossacks still preferring the old town, but that it had already 1721 houses (of which 217 were of stone) one story high, broad regular streets, and 11,327 inhabitants, and was the residence of the Ataman, and the seat of the government offices. Among the public buildings there are a gymnasium and eight churches; one of them, which is very large, was built in honour of the memory of Platoff, the celebrated Hetman (or Ataman) of the Cossacks. As all the public offices, the schools, hospitals, are removed to the new town, the population of the old town gradually decreases. The chief trade is with Taganrog, to which place fish, caviar, and wine are exported.

(Hassel, *Handbuch*; Cannabich, *Lehrbuch*; Stein, *Lexicon.*)

TSCHERNIGOW. [Czernigow.]

TSCHIRNHAUSEN, EHRENFRIED WALTHER VON, a celebrated German mathematician and philosopher of the seventeenth century, was descended from a noble family, and born at Kieslingswald in Upper Lusatia, April 13, 1651. Having received in his father's house the elements of a scientific education, and evinced considerable inclination for mathematical pursuits, he was sent at seventeen years of age to the university of Leyden in order to complete his studies. Here he became intimately acquainted with the Baron de Niewland, who, being appointed to the command of a regiment in the war which, in 1672, broke out between France and Holland, induced the young Tschirnhausen to accompany him as a volunteer. After serving eighteen months in the Dutch army, his father recommended him to travel, and he spent several years in visiting England, France, Sicily, and Italy, returning to Kieslingswald through Germany, where he passed some time at the court of the emperor Leopold. During his absence from home he found means to collect much information respecting the subjects of natural philosophy, and it appears to have been then that he investigated the nature of the curves which are called caustics, and which have since borne his name. [Caustic.]

Dr. Barrow, in his optical lectures, had previously described the manner in which the rays of light cross each other near the focus of a reflecting mirror, but M. Tschirnhausen was the first who discovered the curve to which the reflected rays are tangents. In a paper which was read before the Académie des Sciences at Paris in 1682, he showed that the caustic formed by parallel rays when reflected from the concave surface of a hemisphere is an epicycloid, but he fell into a mistake in determining the relation between its abscissæ and ordinates. The properties of this curve were afterwards accurately investigated by MM. De la Hire and Bernoulli.

On his return to his native place he formed the project of making burning lenses of great dimensions, but there being at that time in Saxony no establishment for executing works of magnitude in glass, Tschirnhausen obtained from the elector permission to form one, and, this succeeding, two others were soon afterwards founded. The first lens which he cast and ground was of the kind called double convex. It was more than one foot in diameter, and its focal length was 32 feet. He appears to have used it as a telescope, for he states that, without either a tube or an eye-glass, he had seen through it the whole of a town at the distance of about a mile and a half (about seven English miles). Nearly at the same time he made a double-convex burning-glass, 3 feet in diameter and 12 feet in focal length, which weighed 160 pounds. The diameter of the sun's image in its focus was about 1½ inch, and by means of a small lens placed between the former and the focus the diameter of that image was reduced to about two-thirds of an inch. The effects produced by this mirror are stated in the 'Mémoires de l'Académie' (1699), and from the account it appears that it was capable of burning wood when green, and even when wet; it melted thin plates of iron, and vitrified slate and earthenware. This mirror was purchased by the duke of Orleans, then regent, and given to the Academy. Tschirnhausen afterwards made a similar lens, which he presented to the emperor Leopold, and this prince in return would have created him a baron of the empire. The philosopher however declined the honour, accepting only a portrait of the emperor and a chain of gold. He also made a concave mirror of thin copper, about 4½ feet in diameter and 12 feet in focal length, and the effects produced by it, which were similar to those produced by the glass lens, are described in the 'Acta Eruditorum,' Lips., 1687. It is stated that the rays of the moon, being concentrated by the lens or by the mirror, though they produced a brilliant image, gave no sensible degree of heat; and the like circumstance is related of the lunar rays when concentrated by the great lens which was executed in 1802 by Mr. Parker in London.

The principles of the infinitesimal calculus were, in the time of Tschirnhausen, not generally admitted among mathematicians, and the Saxon philosopher was one who gave the preference to the more elementary processes of the antient geometry in researches relating to the properties of curves. Entertaining the opinion that the most simple methods are the most correct, he concluded that the modern analysis might be dispensed with; and in 1701 he read in Paris, at a meeting of the Academy, a 'Mémoire' containing rules for finding the tangents to certain curves, together with investigations of their rectifications and quadratures, agreeably to the method followed by the antients; that is, without the consideration of infinitesimal quantities. At the commencement of the following year he read a second 'Mémoire' on the like subjects, with relation to those curves which are called mechanical, and in this he affirms that the process which he used was applicable to curves of all kinds. The process excited some notice at the time, and the observations made on it by Bernoulli, L'Hôpital, and other mathematicians will be found among the Mémoires which have been inserted in the volumes published by the Academy, but it now possesses only an historical interest.

In 1686 and 1687 Tschirnhausen published at Amsterdam two philosophical works, of which the first is entitled 'Medicina Corporis,' and in this rules are delivered for preserving health. The other is called 'Medicina Mentis.' It contains a development of the perceptions of pleasure and pain in the mind, and of external objects by means of the senses, but it constitutes chiefly a course of logic for persons engaged in the study of the mathematical sciences. In this work Tschirnhausen mentions the properties of a curve line which has since borne his name. It is formed by dividing the quadrantal arc of a circle, and the radius passing through one of its extremities, into a like number of equal parts, and drawing lines through the points of division in each respectively, parallel to one another. The points of intersection are in the curve line. For its equation, see Quadratrix.

Tschirnhausen rendered considerable service to his country by the discovery of a method of making porcelain similar to that which is obtained from China. From this discovery arose the manufacture of the Saxon porcelain.

He died in October, 1708, and was buried with pomp at one of his own estates in Saxony, the king of Poland (Augustus), from respect to his memory, defraying the expenses of the funeral.

TSCHUDI, GILLES (in Latin *Aegidius Tschudus* or *Tschudius*), is regarded as the father of Swiss history. He was born in 1505, in the town of Glarus, where his family, which ranked among the nobility of the canton, had been long established. One of his early instructors was Zwinglius, afterwards the eminent reformer; and at a later date he studied at Basle under Glareanus, the poet and scholar of Erasmus. Having accompanied Glareanus to Paris, he remained in that city till 1530, when he returned home; and the rest of his life, with the exception of the space from 1541 to 1549, when he is stated to have been employed in the service of France (but in what capacity is not explained), was spent in filling the successive offices of the magistracy in his native state, of which he rose to be Landammann, or governor, in 1558. Tschudi employed the authority of his station and his personal influence in moderating the heats excited among his countrymen by the religious contentions of the time, but remained himself a member of the Roman Catholic church till his death in 1572. He is the author of numerous works, the greater part of which however still remain in manuscript. In 1538 (not 1530, as stated in the 'Biographie Universelle') appeared, in a small quarto volume, at Basle, a geographical account of Switzerland in Latin, by Tschudi, under the title of 'Aegidii Tschudi Claronensis, viri apud Helvetios clarissimi, de prisca ac vera Alpina Rhaetia, cum caetero Alpinarum gentium tractu, nobilis ac erudita ex optimis quibusque ac probatissimis autoribus Descriptio.' But this is only a translation of Tschudi's work, which was probably written in German, and which does not appear to have ever been printed. The translator was Sebastian Münster, who dedicates his performance to Tschudi himself in a very encomiastic address, at the end of which he seems to intimate that he was then a very young man ('notius est hodie in orbe Munsteri nomen, quam ut ob meam infantiam à studiosis veniam petere anxie contendam'). Perhaps this was a son of Sebastian Münster, the celebrated Hebraist, who himself was nearly fifty by this time. A second edition of the book appeared, also in quarto and at Basle, in 1560, in the title of which (otherwise somewhat varied) we have a peculiar spelling of the author's name—'antore Aegidio Schudo Claronense' (sic). Appended to this edition is a table of latitudes and longitudes, by the learned Conrad Lycosthenes, of Ruffach (Rubeaquensis). Another work of Tschudi's, which the 'Biographie Universelle' says was published in his lifetime, but not by himself, is described as 'Cartes de la Suisse, 1560 and 1595;' being, we suppose, an Atlas of Switzerland, but where published, or in what form or language, does not appear. For an account or list of Tschudi's numerous writings still remaining in manuscript, and dispersed in the libraries of Zürich, St. Gall, Glarus, &c., we must refer to his article, by Ustéri, in the 'Biographie Universelle,' which professes to be compiled from a German Memoir of Tschudi, by Ildephonse Fuchs, published at St. Gall, in 2 vols. 8vo., in 1805. It is however impossible to make out from that article in what language some of them are composed. The most important work of Tschudi's that has been printed is his Chronicle of Switzerland from A.D. 1000 to 1470, which was published at Basle, in 2 vols. folio. in 1734 and 1736, by Dr. Johann Rudolff Iselin (not J. B. Dselin, as in 'Biog. Univ.'), under the title of 'Aegidii Tschudii, gewesenen Landammanns zu Glarus, Chronicon Helveticum.' This work, which is in German, enjoys the highest reputation and authority as one of the main foundations of Swiss history. A sequel, coming down to 1564, is said to be extant in MS. Another treatise of Tschudi's, which the 'Biographie Universelle' calls his classic work, is said to have been published at Constance in 1758, by Jacques Gallati, under the title of 'Description de l'ancienne Gallia Comata,' but in what language it is written is not stated. We doubt if this be anything more than a French translation of his Description of Switzerland, already mentioned.

TSCHUGUJEW is a large town in the government of Slobode-Ukraine, situated in 50° 11′ N. lat. and 36° 45′ E. long., at the junction of the Tschugewka with the Donez. It is a Cossack town, which is under its own military administration, and is the seat of a regiment of Hulans called by its name. The place is surrounded by ramparts and a moat, and has in it seven churches, a school, and other public institutions. There are at least 10,000 inhabitants, some of whom are converted Calmucks or their descendants. They are much employed in tanning, in the manufacture of cordage, saddlery, of girdles of camels'-hair and saddle-girths of hemp, and have a considerable trade by land. The adjacent country produces abundance of fruit and wine. The annual fairs are much frequented.

(Hassel, *Handbuch*; Cannabich, *Lehrbuch*; Stein, *Geographisches Lexicon*.)

TSHOOKTSHES. [Siberia.]

TSHUDES. [Russian Empire.]

TUAM, a city in Ireland, partly in the barony of Dunmore, partly in that of Clare, in the county of Galway, 126 miles west of Dublin, by the road through Leixlip, Kinnegad, Athlone, Ballinasloe, and Castle Blakeney, in 53° 30′ N. lat. and 8° 45′ W. long. An abbey is said to have been founded here as early as the year 487, under the invocation of the Virgin; and this abbey is further said to have been made a cathedral by St. Jarlath early in the sixth century: this latter statement would be liable to some doubt, as there occurs mention of three 'abbots' of Tuam after St. Jarlath's death, two of them as late as the latter end of the ninth century, were it not that in the antient Irish records the title of abbot is repeatedly given to bishops or archbishops. Mention of a bishop of Tuam about the close of the eighth century occurs in the Irish writers. The first archbishop who received the pall from Rome was Edan O'Hoisin or Aeda-Va-Deisin, who rebuilt the cathedral in the middle of the twelfth century; but some of his predecessors are called by the Irish writers archbishops of Connaught. A little before the rebuilding of the cathedral by Edan, a priory, dedicated to St. John the Baptist, was established here by Tirdelvac O'Conor, king of Ireland; but to what order it belonged is not ascertained. An abbey for Premonstratensian or White Canons, dedicated to the Holy Trinity, was founded by one of the De Burgh or De Burgo family, either in the reign of John or the early part of the reign of Henry III. In the twelfth century a castle was erected here by Roderic O'Conor, king of Ireland, of which (or more probably of a similar building of later date) there are some slight remains. In A.D. 1244, Tuam with all its churches was destroyed by fire; and in A.D. 1356 it was plundered and set on fire by Charles Oge, or Young Charles, son of William de Burgo.

The parish of Tuam has an area of 13,799 acres: its greatest length is seven miles, its greatest breadth four: the population in 1831 was 14,219, of whom 6883 were in the town. The parish extends into the two baronies of Clare and Dunmore, and the half barony of Ballymoe, but the town is wholly in Dunmore and Clare, chiefly in the latter. It occupies a low flat site on both sides of the river Harrow (a small affluent of the river Clare, which flows by Lough Corrib into Galway Bay), and consists of several streets, the principal of which meet in the market-place in the centre of the town. The streets are not lighted, flagged, or watched. The houses are for the most part neatly built, and some of them are large and handsome. The cathedral, which is also the parish-church, is on the west side of the town: it retains some portions of antient Norman architecture. It is a small building, capable of accommodating about four hundred persons. Not far from the cathedral are the remains of an old church, and there are vestiges of others in different parts of the town. The Roman Catholic cathedral is on the east side of the town, and is a handsome cross church of richly ornamented Gothic architecture: at the west end is a lofty tower, under which is the principal entrance, formed by an elegant pointed arch with rich mouldings: at the east end is a lofty oriel window with stained glass. This cathedral is quite of modern erection: we are not aware whether it is yet finished: it is one of the richest ecclesiastical structures in the island. There are a Roman Catholic chapel, and a Roman Catholic college for the education of young men for the priesthood, and also for general education, founded A.D. 1814, by Dr. Kelly, the late Catholic archbishop of Tuam. There is also a presentation nunnery. The plan of Tuam, given by the Municipal Boundary Commissioners, marks the site of St. Mary's abbey, but what remains of the building exist we are not aware. The bishop (of the Anglican church) has a palace and handsome grounds close to the town; and there are a barrack for the military, one for the police, a neat market-house, a small bridewell or gaol, and a court-house, in which general sessions for the borough were a few years since held twice in the year, and petty sessions weekly. The business of the town consists in the supply of the neighbouring districts with various articles for the home trade obtained from Dublin or from the port of Galway. Malting and brewing are carried on: there are some flour-mills and a tannery. Some coarse linens are made. There are two weekly markets and five yearly fairs. The quantity of grain sold yearly in the market of Tuam, on the average of the ten years from 1826 to 1835, both inclusive, was 468 tons of wheat, 364 tons of barley, and 2340 tons of oats.

The inhabitants of Tuam were incorporated by charter of James I., A.D. 1613; but the corporation has been dissolved by the late act 3 & 4 Victoria, c. 108. The borough returned two members to the Irish parliament, but was disfranchised at the union.

The parish of Tuam is a vicarage at the head of an ecclesiastical union comprising six contiguous parishes in the counties of Galway and Mayo, forming a district of about 55 square miles, with a population of nearly 28,000 in 1831, and nearly 30,000 in 1834, of whom about 500 belonged to the established church, the rest were Roman Catholics. There are two churches in the union (including the cathedral) and one chapel-of-ease. There are eight Roman Catholic chapels in the union, without (we believe) including the cathedral. The net yearly value of the benefice is about 626*l.*, with a glebe-house.

The parish contained, according to the 'Report of the Commissioners of Public Instruction' (*Parl. Papers*, 1835, vol. xxxiv.), the Roman Catholic college and twenty-seven day-schools of all sorts. The Roman Catholic college had six professors, and contained 129 students, of whom 95 were boarded in the establishment: the instruction comprehended classics, mathematics, and theology. Of the schools, two were private boarding-schools, one was the free model-school of the Tuam Diocesan Education Society, with 79 pupils; three were free-schools in connection with the National Board of Education, with an aggregate number of 365 children: the rest were private day-schools or hedge-schools.

TUAM, DIOCESE OF. A brief notice of the establishment of this bishopric and its erection into an archbishopric is given in the preceding article. The diocese was augmented in the earlier part of the fourteenth century by the incorporation of the diocese of Enaghdune, to which the archbishops of Tuam had laid claim many years before. In the middle of the sixteenth century it was further augmented by the incorporation of the bishopric of Magio or Mageo (now Mayo). Ware supposes this incorporation to have taken place A.D. 1210, but Usher and Harris (in his edition of Ware) bring it down to A.D. 1559. The diocese of Ardagh, in the province of Armagh, was annexed to Tuam, but not incorporated, A.D. 1741; and the united dioceses of Killala and Achonry [KILLALA] were annexed to the diocese of Tuam, A.D. 1835. In 1839 the see was reduced from its archiepiscopal rank and its province united to that of Armagh. These last two changes were made by virtue of the act 3 & 4 William IV., c. 37.

The diocese of Tuam, including the old dioceses of Magio or Mayo, and Enaghdune, comprehends the greater part of the county of Galway, a considerable portion of Mayo, and a small part of Roscommon. It is bounded on the west and south by the Atlantic, on the south-east by the bishoprics of Kilmacduagh and Clonfert, on the east by the bishopric of Elphin, on the north-east by that of Achonry, and on the north by that of Killala. There is a small detached portion east of the main part of the diocese, surrounded by the bishoprics of Clonfert, Elphin, and Meath. The dimensions of the diocese of Tuam are given by Dr. Beaufort at 60 Irish or 77 English miles for the length, and 50 Irish or 63 English miles for the breadth. The area, number of parishes, benefices, and churches, are given by the same author, as follows:—

	Irish Acres.	Parishes.	Benefices.	Churches.
Galway .	675,250	49	11	12
Mayo . .	424,700	37	10	11
Roscommon	35,700	3	3	1
	1,135,650	89	24	24

This area is equal to 1,824,487 acres, or 2850 square miles English measure.

The 'Report of the Commissioners of Public Instruction' (*Parl. Papers*, 1835, vol. xxxiii.) gives 90 parishes, forming 34 benefices (viz. 15 single parishes and 19 unions), and having 31 churches, and 18 other places of worship of the establishment. There were at the same time 134 places of worship for Roman Catholics and 10 for Protestant dissenters. The population of the diocese in 1834 was nearly 480,000, of whom only about one in fifty belonged to the established church. The remainder were almost exclusively Roman Catholics, the number of Protestant dissenters of every denomination being little more than 400. The gross yearly revenue of the archbishop was returned in 1833 at 8206*l*. 3*s*. 9¾*d*., viz. 5020*l*. 1*s*. 3¼*d*. for the revenues of the see, and 3186*l*. 2*s*. 6½*d*. for annexed preferments; the net revenue was 6996*l*. 9*s*. 0½*d*., viz. 4018*l*. 17*s*. 9½*d*. for the see, and 2977*l*. 11*s*. 3*d*. for the preferments. The chapter consists of a dean, a provost, an archdeacon, and eight prebendaries. There is one vicar choral whose office is a corporation in itself. The gross yearly income of the vicar-choral was returned at 197*l*. 0*s*. 7½*d*. The dean and chapter had no corporate revenues divisible among the members: the gross income of the 'economy estates' for the payment of salaries to the organist, &c. was 174*l*. 10*s*. 10*d*.

The number of schools in the diocese, by the 'Report of the Commissioners of Public Instruction' (*Parl. Papers*, 1835, vol. xxxiv.), was 453, viz. 308 wholly supported by payments from the pupils, and 145 supported wholly or in part by endowment or subscription: 51 of these were in connection with the National Board, 16 in connection with the London Hibernian Society, 7 with the Kildare-Street Society, 2 with Erasmus Smith's fund, and 1 with the Association for Discountenancing Vice.

The number of children on the books of 370 of these schools was 24,743, viz. 16,247 boys, 8020 girls, and 476 children of sex not stated. No lists were given from the remaining 83 schools, but the number of children was estimated at 5561, giving an estimated total of 30,304. These computations give one school to every 1055 of the population (computed at 478,021), and make the children under instruction amount to $6\frac{34}{100}$ per cent. of the total population. This is below the proportion in the other dioceses of the province, except Killala, and below all the other dioceses of Ireland, except Emly, Cloyne, Ardfert and Aghadoe, Limerick, Killaloe and Kilfenora.

In the Roman Catholic division of Ireland the diocese of Tuam has been lately diminished by the erection of the new diocese of Galway, which took place on the dissolution of the Roman Catholic wardenship of Galway in 1831.

The archbishop of Tuam had for his suffragans the bishops of Clonfert and Kilmacduagh, of Elphin, and of Killala and Achonry.

(Ware's *History and Antiquities of Ireland*, translated and improved by Harris; Archdall's *Monasticon Hibernicum*; Beaufort's *Memoir of a Map of Ireland*; Lewis's *Topographical Dictionary of Ireland*; *Dublin Almanac*, *Parliamentary Papers*.)

TUARIKS. [SAHARA.]

TUBASTIÆA. [MADREPHYLLIÆA.]

TUBASTRÆA. [MADREPHYLLIÆA.]

TUBBUS. [PERSIA.]

TUBE. The surface of a tube is generally a cylinder, but this word may be made use of in mathematics. When a tube is bent, there is no distinct geometrical name for its surface, but the following definition might do very well: let a surface be called a tube when it is formed by a circle which moves with its centre upon a given curve, and its plane always perpendicular to the tangent of that curve. This would include the straight tube, or common circular cylinder, and every species of bent tube.

TUBE, EUSTACHIAN. [EAR.]

TUBER, in systematic botany. [TUBERACEÆ.]

TUBER, in structural botany. [STEM.]

TUBERA′CEÆ, a section of the suborder Gasteromycetes, of the natural order of Fungi. It is known by its sporangia being membranaceous and scattered on a serpentine vein-like hymenium, and included in a concrete uterus. The sporidia are at first pulpy. This section includes the genus *Tuber*, the common truffle, and *Rhizopogon*, the white truffle. The species of these genera are not numerous, and are found very generally diffused throughout the temperate parts of the world, and growing buried beneath the soil.

The genus *Tuber* has a closed uterus marbled internally with veins, the sporangia are pedicillate and confined to the veins.

T. cibarium, the common Truffle, is known by its surface being warty and of a black colour. It is found buried in the soil of woods, especially beech-woods, sometimes at the depth of 10 or 12 inches or more. It is a native of Europe and is also found in Japan and the East Indies. It grows abundantly in some parts of England. This is one of the few species of the natural order Fungi that is used as an article of diet. For this purpose they appear to have been used by the Greeks and Romans: the latter especially considered them a delicacy. It may be however a question as to whether the Roman *tuber* is really the common truffle. There can however be no doubt that it had a similar form, origin, and use. The truffle when gathered for eating is about the size of a large walnut, and has a very peculiar smell. The flavour is not remarkable, and resembles in some measure that of the mushroom and morel. Its reputation however as an article of diet does not depend so much on its flavour as its supposed aphrodisiac virtues. That this supposition is true may perhaps be questioned, but it is deserving of notice that they are not very digestible, and that they are supposed to possess this quality in common with cheese, chestnuts, and other indigestible substances. When eaten they are either cooked with various sauces, and served up with other dishes, or sliced and pared, and eaten with oil, salt, and pepper. As the truffle exists underground and cannot be easily cultivated, there would be some difficulty in procuring it were it not for its powerful scent. This attracts many animals to the spot where they grow, especially pigs, which are very fond of eating them; hence the truffle is sometimes called swine-bread, and pigs used to be employed for hunting truffles. Dogs however have the same perception of the odour of these fungi, and, being more easily trained, are employed to scent them, and sometimes to scratch them out of the earth. 'Nees von Esenbeck,' says Mr. Berkeley, 'relates an instance of a poor crippled boy who could detect truffles with a certainty superior even to that of the best dogs, and so earned a livelihood.' Attempts have frequently been made to cultivate them, but without much success. Mr. Berkeley relates that Bornholz had succeeded in reproducing them. The chief part of the truffles found in the English markets are brought from France and Italy, where they are more abundant than in this country, and where hunting them is pursued by some persons as an occupation. In warm moist weather truffles may be found all the year round, but they are most abundant in August and September. When the air is loaded with moisture before a thunder-storm, their odour is very perceptible, and they have hence obtained the name of thunder-roots. The truffle is subject to the attacks of many insects: a species of Leiodes deposits its ova in it, which in the pupa state feed upon the substance of the truffle; in this state they are called truffle-worms.

T. moschatum, Musk-scented Truffle, has a roundish, smooth, blackish appearance, and is a much rarer plant than the last. It has been found in Great Britain, and is characterised by the musky odour which it gives out.

The genus *Rhizopogon* has a sessile uterus, bursting irregularly and marbled internally with anastomozing veins and sessile sporangia. The *R. albus* of Bulliard is the Tuber albus of older botanists, and is called white truffle, and by some writers, from its Greek appellation, root-beard. The plant is round, rather rugged, at first white and then reddish brown, and slightly fibrillose at its base. It is found on sandy ground in woods, but is a rare plant. It differs from the common truffle in not being buried entirely in the earth: a part of its globular uterus appears above the surface.

TUBERCULARI'NI, a tribe of plants belonging to the suborder Coniomycetes, of the order Fungi. The species are characterised by their sporidia being glued together and forming an erumpent disc. It includes the genera *Tubercularia* and *Fusarium*. All the species are found on dead and decaying sticks and branches, and trunks of trees, and on the decaying stems of various herbs. The *Tubercularia vulgaris* is a very common fungus, and is found on dead branches, especially those of the currant tree, in the autumn of the year. It forms upon these branches little scarlet or rose-coloured patches which are frequently very conspicuous. The *Fusarium roseum* forms smaller red patches than the last, and is found on the stems of decaying herbaceous plants, as those of the bean, tulip, Jerusalem artichoke, &c.

TUBEROSE. [POLYANTHES TUBEROSA.]

TUBICINELLA. [CIRRIPEDA, vol. vii., p. 210; WHALES.]

TUBI'COLÆ. The *Tubicoles* of Cuvier, commonly called by the French *Pinceaux de Mer*, form the first order of his Annelids.

The *Tubicoles* have branchiæ in the form of plumes, or of small arborizations, attached to the head or on the anterior part of the body, and nearly all inhabit tubes.

Of those which inhabit tubes, some form a calcareous, homogeneous one, resulting probably from their transudation, like the shells of the mollusca, but they do not adhere to it by means of muscles: others construct a tube by agglutinating grains of sand, fragments of shells, or particles of sand by means of a membrane which they doubtless transude also: there are others again whose tube is entirely membranous or horny. (*Règne Animal.*)

To the first category belongs the genus

Serpula.

The species of this genus are the *Tuyaux de Mer* of the French, and their twisting calcareous tubes cover stones, shells, and other submarine bodies. The section of these tubes is sometimes round and sometimes angular, according to the species.

Cuvier describes the animal as having a body composed of a great number of segments; its anterior part enlarged into a disk, armed on each side with many bundles of stiff bristle-like appendages, and on each side of the mouth a plume of branchiæ in the form of a fan, ordinarily tinted with vivid colours. At the base of each plume is a fleshy filament; and one of the two, that to the right or left indifferently, is always prolonged and dilated at its extremity into a disk of different configuration, which serves as an *operculum*, and closes the aperture of the tube when the animal retires within it. Cuvier further observes that the most common species having this disk in the form of a funnel, some naturalists have mistaken it for a proboscis: but it is not pierced; and the other species have it more or less of a club-shape.

The number of species of *Serpula* (Lam.) admitted into the last edition of *Animaux sans Vertèbres*, is sixty recent and fossil; and M. Milne Edwards adds many more at the end of the genus: but he observes that very little is known of the specific differences presented by these animals, and that many of the living and all of the fossil species are characterised in a very doubtful manner. The fossils are said to be found in the tertiary, green-sand, chalk (environs of Münster and Maastricht), lias, and oolite beds, &c. Mr. Lea describes a species, *Serpula ornata*, from the tertiary of Alabama (Claiborne beds).

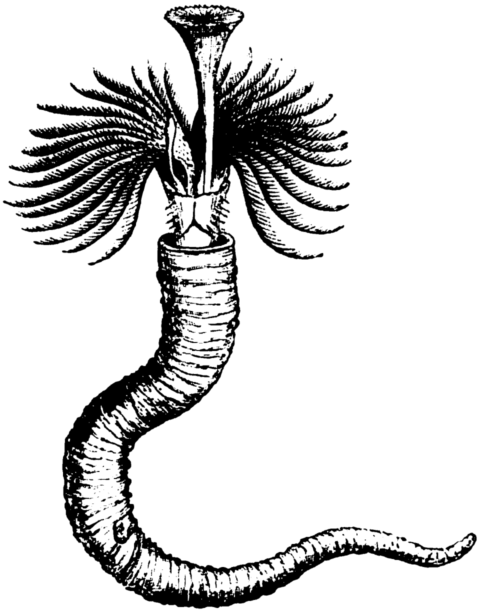
Dr. Fitton records fourteen named species and two uncertain species from the *strata below the chalk*, ranging from the upper green-sand to the Kimmeridge clay.

Mr. Murchison notices *Serpulites* and *Spirorbis* in the Silurian rocks, *Serpulites longissimus* in the upper Ludlow rock, and *Spirorbis tenuis* in the lower Ludlow rock, and in the Wenlock limestone. (See Mr. MacLeay's paper, post, p. 330.)

Mr. Murchison also records the presence of *Serpula* (*Serpula omphaloïdes*, Goldf.) in the Devonian rocks of Russia. (See his forthcoming work, on the 'Geology of Russia in Europe and the Ural Mountains.')

Example, *Serpula contortuplicata.* The tubes of this *Serpula* are round, twisted, and about three lines in diameter. Its *operculum* is funnel-shaped, and its branchiæ are often of a beautiful red, or variegated with yellow and violet. It quickly covers vases, bottles, or other objects thrown into the sea.

Locality.—The Mediterranean and European seas.



Serpula contortuplicata.

In other species (genus *Galeolaria*, Lam.) the operculum is flat and beset with points.

Cuvier notices another species from the Antilles (*Serpula gigantea*, Pallas), which lives among the madrepores, and whose tube is often surrounded by their masses. Its *branchiæ* are rolled into a spiral form when they re-enter; and its operculum is armed with two small branched horns, like the antlers of a stag. This species is the *Terebella bicornis*, 'Abildg. Berl. Schr.' ix. iii. 4; *Actinia*, or *Animal Flower*, Home, 'Lect. on Comp. Anat.' ii. pl. 1. Upon this spiral rolling up of the branchiæ Savigny established his subdivision of *Cymospire Serpulæ*, from which M. de Blainville afterwards established a genus.

The genus *Spirorbis*, Lam., consists of those *Serpulæ* whose branchial filaments are much less numerous, only three or four on each side: their tube is rolled up into a tolerably regular spiral, and they are ordinarily very small.

Sabella.

The species of this genus have the same body and the same fan-shaped branchiæ as the *Serpulæ*; but their two fleshy filaments adhering to the branchiæ each terminate in a point, and do not form an *operculum*: they are even sometimes absent. The tube of the *Sabellæ* appears, most frequently, to be composed of grains of sand, of clay, or very fine mud, and is rarely calcareous. The known species are rather large, and Cuvier notices their branchial plumes as being of admirable delicacy and brilliancy.

Example, *Sabella protula*, Cuv. (*Protula Rudolphii*, Risso). This beautiful and large species, with a calcareous tube like that of the *Serpulæ*, has the branchiæ of a rich orange.

Terebella.

The *Terebellæ*, like the greater part of the *Sabellæ*, inhabit a factitious tube; but it is composed of grains of sand and fragments of shells: their body, moreover, has much fewer rings, and their head is differently ornamented. Numerous filiform tentacles, susceptible of much extension, surround their mouth, and on their neck are arborescent, not fan-shaped branchiæ.

Example, *Terebella conchilega*.

Amphitrite.

Cuvier remarks that the species of this genus are easily known by straw-like processes ranged in a pectinated form, or in that of a crown, in one or more rows, where they probably serve for defence, or perhaps as means of creeping or collecting the materials for their tube. Around the mouth are very numerous tentacles, and on the commencement of the back on each side are branchiæ in the form of a comb.

Cuvier's genus Amphitrite comprehends the *Pectinariæ* of Lamarck, the *Amphictènes* of Savigny, the *Chrysodons* of Oken, the *Cistenes* of Leach, the *Sabellariæ* of Lamarck, the *Hermelles* of Savigny, and the genus *Pherusa* of De Blainville.

Siphostoma (Otto).

The species of this genus, which Cuvier suspects should be referred to this order, have on each articulation above a bundle of fine bristles; below, a simple bristle; and, at the anterior extremity, two packets of strong and golden-coloured bristles. Under these bristles is the mouth, preceded by a sucker, surrounded by many soft filaments, which Cuvier thinks may be branchiæ, and accompanied by two fleshy tentacles. The knotted medullary chord may be seen through the skin of the belly. The *Siphostomata* live burrowed in the sand.

Examples, *Siphostoma diplochaitos*, Oken; *Siph. uncinata*, Aud. et Edw. 'Littoral de France, Annel.' pl. ix., f. 1.

Cuvier closes his *Tubicoles* with Dentalium.

The following situations have been noticed as frequented by these annelids:—

Serpula (including *Vermilia* and *Galeolaria*, Lam.) may be said to be, generally, littoral, attached to rocks, stones, shells, crustaceans, corals, and other marine bodies.

Spirorbis is found on sea-weed, shells, &c., and nearly in the same situations.

Sabella occurs on the coasts, on shells, &c., and generally in shallow water.

Terebella haunts nearly the same localities.

Here we would call attention to Mr. W. S. MacLeay's valuable 'Note on the Annelida,' in Mr. Murchison's 'Silurian System,' part ii.

Mr. MacLeay commences by observing that the Annelids differ from the true *Annulosa* in being hermaphrodite, and in general red-blooded; and with regard to this part of their organization, he remarks that M. Milne Edwards is said in the public journals to have discovered that some *Annelida* are not provided with red blood; but the distinguished Savigny, he adds, stated the same fact so long ago as the year 1823, for in his 'Système des Annelides' he places *Clepsine* among his *Hirudinées*: nay, even Cuvier, who first distinctly pointed out the group under the name of *vers à sang rouge*, has said that their blood is only generally red.

Mr. MacLeay describes them further as soft vermiform animals of an articulated structure, and which form the immediate connection between such *Vertebrata* as *Amphioxus* and *Myxine*, and such *Annulosa* as *Porocephalus* and other white-blooded *Vermes* which have the sexes distinct. Although hermaphrodites, many of them, he says, require a reciprocal coitus.

The following division of the *Annelida* is proposed by Mr. MacLeay:—

Annelida.

Normal Group.		
Polypoda. Marine animals having their body provided with distinct feet.	**Nereidina.**	Animals free, having a distinct head provided with either eyes or antennæ, or both
	Serpulina.	Animals sedentary, and having no head, provided with eyes and antennæ.
Aberrant Group.		
Apoda. Body without feet or a distinct head.	**Lumbricina.**	Animals without eyes or antennæ. Body externally setigerous for locomotion. Articulation indistinct.
	Nemertina.	Animals aquatic, without eyes or antennæ. Body not externally setigerous. Articulation indistinct
	Hirudina.	Animals provided generally with eyes but not with antennæ. Body not externally setigerous. Articulation distinct.

Nereidina. MacLeay.

These Mr. MacLeay considers to be the most perfect in their structure of all *Annelida*, as they possess numerous organs and have a distinct head, which is generally provided with eyes and an antennæ. 'Some of them,' says Mr. MacLeay in continuation, 'after the manner of *Serpulina*, inhabit tubes, which tubes are membranaceous, and formed by a transudation from their body; but, in general, the *Nereidina* are naked, and they are always agile animals, freely moving about in search of their prey. Aristotle calls them Σκολόπενδραι θαλάσσιαι παραπλήσιαι τῷ εἴδει ταῖς χερσαίαις (lib. ii., c. 121)*; and it is true that they are wonderfully like Centipedes. The fossil impressions in the Llampeter rocks are too indistinct to enable us to determine very accurately the genera and species of *Nereidina* which there occur, more particularly as the generic characters in this group depend on such minute distinctions as are afforded by a study of the mouth, antennæ, and eyes.'

Genus *Nereites*. Closely approaching Savigny's genus *Lycoris* in its external appearance, only the segments of the body are here perhaps more slender and in proportion longer than usual. (MacLeay.)

Of this genus Mr. MacLeay notices two species, viz. *Nereites Cambrensis*, Murch., and *Nereites Sedgwickii*, Murch., figured in pl. 27, fig. 1, 2, of the *Silurian System*, and he says of the latter, that the worm had evidently, before coiling, with difficulty trailed itself along in the mud in a way which any one accustomed to collect these *Annelida* will at once recognise.

Genus *Myrianites*. Body linear, very narrow, and formed of very numerous segments with indistinct feet and short cirri. (MacLeay.)

Example, *Myrianites MacLeaii*, Murch. (*Silur. Syst.* pl. 27, fig. 3.)

Mr. MacLeay remarks that the softness of the texture of the foregoing three species of *Annelida* and the perfection of the impression in fig. 1, make it very remarkable, that if articulated feet existed in the Trilobites, some vestiges of them, even although membranaceous, should not have come down to us more perfect than those figured by Goldfuss; and he refers to *Ann. Scienc. Nat.*, vol. xv., pl. 2 fig. 8, and to his own paper on these crustaceans, for which see the article Trilobites.

Serpulina, MacLeay.

These, says Mr. MacLeay, are sedentary animals, with eyes or antennæ. They live in tubes, which are either a natural transudation of their body and either membranaceous or calcareous, or their tubes are semifactitious, being then composed of an agglutination of particles of sand or other small substances. The calcareous nature of the tube in some *Serpulina* is, Mr. MacLeay observes, very advantageous for their preservation, and has thus enabled us to see that such animals occurred frequently in the Upper Silurian Rocks.

Genus *Serpulites*.

Example, *Serpulites longissimus*, Murch. (*Silur. Syst.*, pl. 5, fig. 1.)

Nemertina, MacLeay.

'The *Nemertina*,' says Mr. MacLeay, 'are white-blooded worms, like some of the *Hirudina* or *Leeches*. In this group however the character of articulation becomes more indistinct. Rudolfi has placed *Gordius* along with *Nemertes* (*Ent. Syst.*, 572); and if *Gordius* goes into the group of *Nemertina*, it is possible that *Filaria* may also. *Nemertes Borlasii* is a long black sea-worm, which is said to suck testaceous *Mollusca*. The articulations of its body become visible when it is contracted. If the long vermiform impression in the Cambrian rocks of Llampeter belong to organic substances, it can only be referred to some animal between *Gordius* and *Nemertes*, although probably nearer the former genus: as yet however *Gordii* are only known in fresh-water, whereas this fossil production, if it belong to the animal kingdom, was evidently, like *Nemertes*, a native of the sea.'

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* 'Sea Scolopendræ closely resembling in form the terrestrial Scolopendræ.' We have given the chapter as quoted, but we find it in the 'Hist. Anim.' lib. ii., c. 14 (Paris, 4to.)..

Genus *Nemertites?* Animal marine, with the linear body of a *Gordius* or *Filaria*. (MacLeay.)

Example, *Nemertites Ollivantii*, Murch. (*Silur. Syst.*, pl. 27, fig. 4.)

TUBICO'LIDÆ. The *Tubicolées* of Lamarck form the first division of his *Conchifères Crassipèdes;* and he commences his *Conchifera* with ASPERGILLUM, and terminates them with *Lingula*, the last genus, according to him, of the BRACHIOPODA.

Lamarck observes that the *Tubicolidæ* are undoubtedly conchifers, but of such great singularity, that some among them have been referred to other classes by modern naturalists; and he adds that it *is* singular to find a bivalve shell inclosed in a testaceous tube, and still more singular to see it incrusted in or built into the wall of that tube, and concurring to complete such wall.

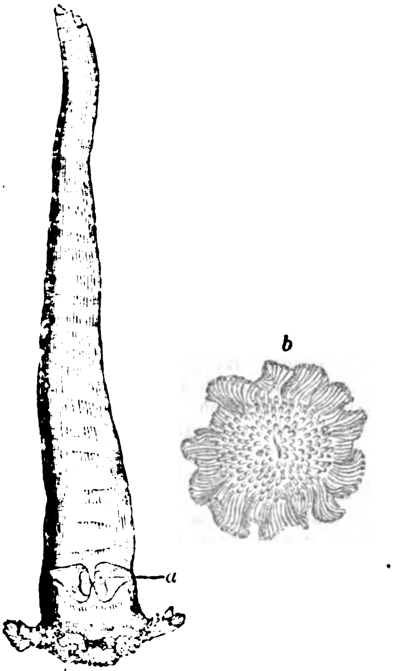
The singularity of the *Tubicolidæ*, as well as that of the *Pholades*, has, he further remarks, caused a misconception of the real essentials of the shells which belong to the family, namely, two similar, equal, regular valves, articulated by a hinge. As in the shells of the *Tubicolidæ*, there are some which have accessory pieces apart from their valves; so, as one sees in the *Pholades*, some naturalists have taken them for multivalve shells, a notion which has given rise to very odd associations.

But, continues Lamarck, the doubts relative to the classification of the *Tubicolidæ* and to those similarities which they exhibit to the *Pholades* are evidently dissipated by the transitional characters which connect *Aspergillum* with *Clavagella*, these last to the *Fistulanæ*, and afterwards to the *Teredines*, which themselves approach the *Pholades*.

Finally, Lamarck points out that the animals of this family are borers, burrowing in stone, wood, and even in thick shells; but some, nevertheless, live in the sand.

The following six genera are arranged by Lamarck under this family,—ASPERGILLUM, CLAVAGELLA, FISTULANA, SEPTARIA, TEREDINA, and TEREDO.

We here subjoin figures of the more remarkable forms of *Aspergillum*.

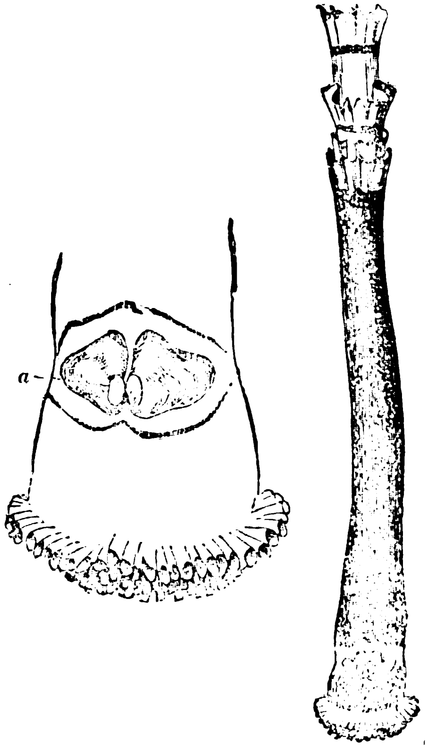


Aspergillum Javanum.
a, the valves incrusted in the tube; *b*, front view of the disk.

Locality.—East Indian Ocean.

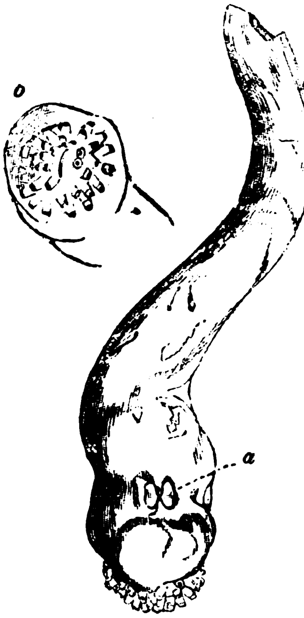
M. Deshayes, in the last edition of the 'Animaux sans Vertèbres,' remarks that the establishment of this family by Lamarck is a proof of the profound sagacity of that zoologist, and that he knew how, at a time when they were rejected, justly to divine the points of relationship which undoubtedly connect the different genera of this family. At the same time M. Deshayes observes that it has long appeared to him possible to ameliorate the family by simplifying it. The genera *Aspergillum*, *Clavagella*, and *Fistulana* alone, he thinks, ought to form it; whilst the three others, *Septaria*, *Teredina*, and *Teredo*, bear the greatest analogy to *Pholas* in general characters: the shells have analogous forms; they have an appendage at the *umbones*, as is seen in the *Pholades;* and they have no true ligament. These three last genera, then, pass into the family of the *Pholades*.

The animal of *Aspergillum vaginiferum* has been found by M. Rüppel, and it appears to bear much analogy to that of *Pholas*.



Aspergillum vaginiferum.
a, the valves incrusted in the tube.

Locality.—The Red Sea.



Aspergillum Novæ Zealandiæ.
a, valves incrusted in tube; *b*, front view of disk.

Locality.—New Zealand.

Fossil Aspergillum.

M. Deshayes, in his Tables, gives the number of recent *Aspergilla* as four, the same that appears in the last edition of the 'Animaux sans Vertèbres,' and one fossil (tertiary) from Bordeaux. *Aspergillum Leognanum*, Hæning., is recorded as the only fossil species in the last edition of the 'Animaux sans Vertèbres.'

Since the article Clavagella was written, M. F. Cailliaud has published, in the 'Magazin de Zoologie' (1842), a well-digested and highly interesting notice on the genus, the result of observations on individuals collected in the course of 1840, in various parts of the Mediterranean and Adriatic seas, at Nice, Venice, Naples, Palermo, and Malta.

M. Cailliaud gives the following characters:—

Animal perforating. *Shell* bivalve, attached to a free tube in the fossil species, and included in the *calcaire* or some marine production in the living state; the anterior part of the tube open, in the form of a ruffled chalice, the posterior part excavated, oval, containing a free valve, and the other affixed to its wall; ligament external.

M. Cailliaud, after quoting the remarks of Broderip (vol. vii., p. 243), says, 'I shall add to the judicious reflections of Broderip some observations which may be deemed conclusive. The agglomerations of *Balanus sulcatus*, which conceal the *Clavagella*, in the gulf of Pozzuoli, are attached in groups on the pozzalana, and it sometimes happens that the *Clavagella*, in introducing itself into these calcareous masses, meets with the pozzolana, which is of a much softer nature than the *calcaire* of the *Balani*, and consequently more easy of disintegration by the continual contact of the water and the mollusk. But, what happens?—the animal makes a deviation (un coude) to enter into the *Balani* and avoid this volcanic tufa, which from its nature we may believe could not be dissolved by the substance or acidulated liquor of the mollusk which dissolves the *calcaire* or lime.

'When the animal of the Clavagella excavates its dwelling, its free valve is entirely open and strongly applied upon the wall of its excavation: in this case the border of epidermis which unites the mantle to the contours of the valves denies a passage to the acidulated liquor, which cannot extend between the free valve and the wall of the excavation, where it might attack the shell. In spite of these precautions one would be led to attribute to a principle of deterioration the white deposit (couche) of lime which covers the striæ on the free valve; but I rather believe that this deposit of lime belongs to the residue produced by the dissolution of the calcareous matter which passes between the excavation and the border of the valve, and that its pasty consistence must, in accordance with the border of the epidermis, prevent the filtration of the acid. As the mollusk can avoid the contact of the acid, which might kill it, it is not more difficult to avoid its attack upon the valve.

'I am induced to believe that this dissolving secretion is only emitted in small quantity; that it is maintained in contact with the stone by the great muscle, and that the dissolved calcareous molecules forthwith absorb its strength; as soon as there is no longer any apposition of the great muscle against the stone, the sea-water would absorb its effects. It is then very easy for the animal to suspend at once its work by admitting the water around it.'

M. Cailliaud observes that in the small number of living *Clavagellæ* known may be observed, as in fossil shells of the same genus, small tubes often co-adapted (accolés) to each other, and placed in various parts of the cell. M. Rang believed that these served to give passage to so many fasciculi of byssus with which the animal is attached to the bottom of its dwelling. But M. Cailliaud remarks that this supposition cannot be allowed; for they would be entirely useless to the mollusk, which is sufficiently attached by its fixed valve. An attentive examination of these little tubes in living *Clavagellæ* has proved to M. Cailliaud that their use was not to afford a passage to the water, as has also been supposed, because in many of the excavations there are neither tubes nor any other communications; that the animal had no byssus; but that their utility was to fill the voids which the mollusk finds on its passage in introducing itself into the stone, voids belonging sometimes to other perforating animals. Thus it is, observes M. Cailliaud, that with these tubular masses the animal fills and closes all the apertures which communicate with its dwelling to separate itself from foreign bodies; and accordingly we perceive that these tubular reunions are always due to chance: one sometimes sees them at the bottom of the dwelling of the mollusk, sometimes in the walls; wherever in fact there is a necessity for closing up, but never with any fixed character.

This leads M. Cailliaud to consider that in the fossil *Clavagellæ* the case is different: these, entirely closed in a sheath analogous to that of Gastrochæna, with which they have much in common, have lived, not like the recent species, in the stone or in the madrepore, but, like the recent *Aspergillum*, perpendicularly plunged for about three-fourths of their length in the sand. May not these tubes then, inquires M. Cailliaud, with which the club of the *Clavagella* is often surrounded, without any determined character, but thrown out at hazard like the roots of a plant, have served as points of support necessary for maintaining the perpendicular tube in the sand and at a convenient height for enabling the aperture above the level of the soil to receive the water? These digitations, he further observes, are less numerous and extended according to the nature of the stratum in which these animals lived; and we accordingly find fossil species hardly provided with any of these tubes, and sometimes they are on one side, sometimes on the other, according, he supposes, as the necessity for solidity was more or less felt, these appendages being for the most part closed by the mollusk, at their contact with the club-shaped portion of the tube, so that they could not be available to the internal organization.

M. Cailliaud then remarks, that if this observation is probable and, as he believes it to be, admissible, these tubular digitations, of which the number, extent, and disposition were subordinate to the circumstances of the soil which these animals occupied, cannot be considered as specific characters; and thus *Clavagellæ echinata*, *coronata*, and *cristata* ought to be examined anew in order to their receiving new names or being united.

The same acute observer states, that at the extremity of the club is often found, as in *Aspergillum*, a small open fissure for giving access to the water into the dwelling of the mollusk, and, indeed, it becomes necessary, since in low tides the upper extremity of the tube is not bathed by the sea-water. *Aspergillum*, he remarks, would seem to be in the same predicament, and the crown formed of tubes, which it bears at its extremity may contribute as a stay to maintain it in a vertical position and at the desired height.

The tube of the fossil *Clavagellæ* is, says the same zoologist, more slender and generally more elongated than in the living species, and this difference may be explained by the change of level of the soil or moving stratum where the fossil species lived and which were obliged to prolong their tube to maintain its aperture constantly above the sand, so that it might receive the sea-water. In these great species, he remarks, their siphons must have sometimes extended from 20 to 23 centimeters.

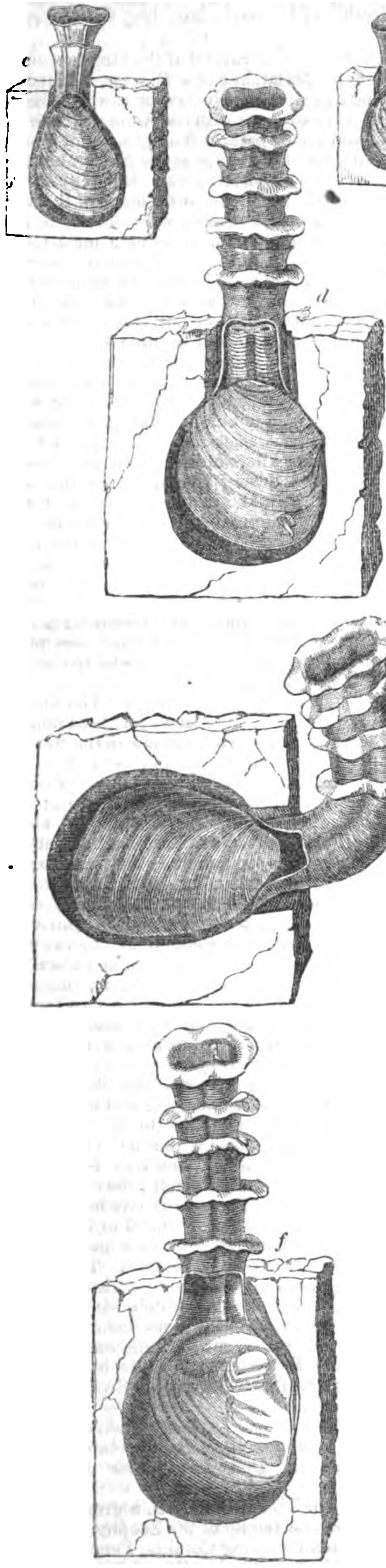
M. Cailliaud goes on to state that one of the most curious facts that he has to relate is the manner in which these small pipes are formed. The epidermis of the great muscle of the mantle is rough, covered with small pustules, whence fleshy filaments, like tentacles, occasionally come forth: these are so many instruments whence the secreting matter is poured out, and with which the mollusk forms those little tubes which are shown in the figure of *Clavagella balanorum*. M. Cailliaud had not been able to see them positively in action, when M. Scacchi of Naples twice surprised these animals in the act of introducing these fleshy filaments into the commenced tubes, which they secreted in a short time; many finished ones were already closed, and when the work was completed, these filaments retired into the epidermis of the great muscle, to reappear again when necessity required their aid.

Our limits will not permit us to follow M. Cailliaud in this valuable paper, the whole of which is worthy of the closest perusal from the malacologist, further than to state that he has paid the greatest attention to the growth and consequent apparent variations of the species, the result of which is the record of the following species:—

1. *Clavagella aperta*, Sow. (*Clav. lata*, Brod.; *Clav. sicula*, Delle Chiaje).
2. *Clavagella balanorum*, Scacchi.

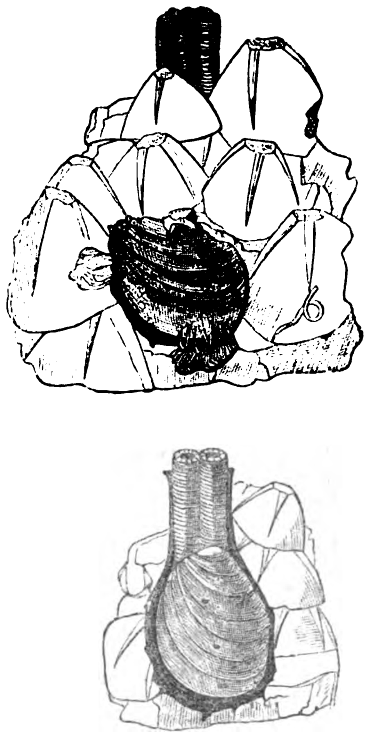
3. *Clavagella elongata*, Brod.
4. *Clavagella melitensis*, Brod.

We subjoin some of M. Cailliaud's figures, which give more information as to the shell than any yet published.



Clavagella aperta.

a, Right valve in a very young state. *b*, The same more advanced, seen in the stone which has been cut to show the excavated part, and the right valve in situ. Its young tube has six facets and develops its first fimbriation or ruffle. *c*, The same still further advanced, also in the stone; its young tube has two ruffles. *d*, The same greatly increased and seen in the stone; a part of the mollusk is seen under its right valve and in its excavation, also the great muscle of the mantle and the aperture whence its small rudimentary foot comes forth: the lower extremity of the tube has been cut away to show the siphons terminated in papillæ: the tube presents five ruffles and the commencement of two others which the mollusk had not finished. *e*, Another specimen, which had entered the stone horizontally and afterwards had prolonged its tube in a perpendicular direction. *f*, Another specimen.



Clavagella balanorum.

In an agglomeration of *balani*: the little tubes above noticed are here seen in the upper figure.

Fistulana.

Sheath tubular, most frequently testaceous, more convex and closed posteriorly, attenuated towards its anterior extremity, open at its summit, containing a free and bivalve shell; the valves equal, and gaping when they are closed.

Animal. . . . having at its anterior part two cyathiferous *calamules*. (Lam.)

M. Rang characterises the animal as being similar to that of Teredo, but shorter.

M. Deshayes remarks, in the last edition of the 'Animaux sans Vertèbres,' that Lamarck is evidently mistaken in supposing that the *calamules*, which he believed to exist in the *Fistulanæ*, were destined to carry the organs of respiration: this error, M. Deshayes observes, is rendered certain by two methods; 1st, The true *Fistulanæ*, although closed on one side, have never any *calamules*; 2nd, These *calamules* belong exclusively to the *Teredines*, and they have their branchiæ disposed as in all the *Conchifera*, and not dependent on these *calamules*. These parts, he adds, are not of the use which Lamarck supposed: they are destined to close the entrance of the tube like a sort of operculum.

The number of species recorded by M. Deshayes in his tables is five living and seven fossil (tertiary); and of these *Fistulanæ gigantea* and *hians* are noted as living and fossil (tertiary). In the last edition of the 'Animaux sans Vertèbres,' four recent species only are given, nor does *Fistulana gigantea* nor *Fist. hians* appear among them: two fossil species only are noticed, *Fistulana ampullaria* and *Fist. pyrum*.

Small as this number is, it ought to be greatly reduced, according to M. Deshayes, who says, that although Lamarck has rendered the genus *Fistulana* more natural, he has nevertheless left more than one error which it is necessary to rectify. M. Deshayes had observed that the genus *Gastrochæna* of Spengler was the same as that named *Fistulana* by Lamarck, but with this difference, that Spengler's genus was more natural. Lamarck, says M. Deshayes, had preserved a genus *Gastrochæna* in the family of *Pholadaires*, but it cannot be retained for this reason: there exist certain *Fistulanæ* (*Fistulana clava*) which make for themselves a tube complete and always free, like that of the *Aspergilla;* other species burrow into the substance of submarine bodies, and their tube serves as a lining for the cavity which they inhabit (*Fistulana ampullaria*); finally, there is a third sort which always burrow into the substance of madrepores, large shells, or soft calcareous rocks: the tube of these last invests the cavity which they occupy, but as their shells can only be obtained by breaking those bodies, inattentive observers have fancied that they were deprived of a tube, and for these incompletely known species Lamarck preserved the genus *Gastrochæna.* M. Deshayes, who states that he has observed with much care the species of the two genera, and detected the identity of their generic characters, whether their mode of life was in a free or included tube, believes that one of the two genera ought to be suppressed.

M. Deshayes then adds strictures as to some of the species admitted by Lamarck into the genus Fistulana.

Fistulana corniformis. M. Deshayes states that the calcareous tubes which bear this name in Lamarck's collection belong without exception to the genus *Teredo.*

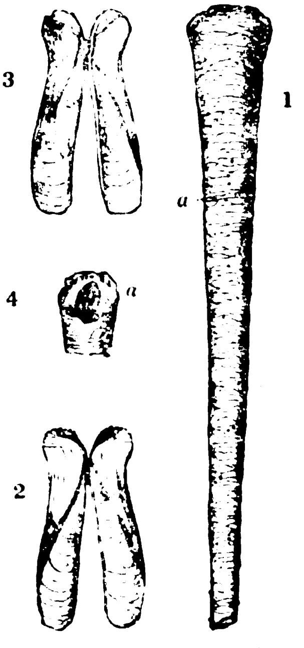
Fistulana gregata. If the structure of the shell accords with the tube, this species again, in the opinion of M. Deshayes, must belong to *Teredo.*

Fistulana lagenula. M. Deshayes had not seen the internal shell of this species: it may, he thinks, also belong to the genus *Teredo;* but this is doubtful.

Fistulana ampullaria. A true *Fistulana,* but remarkable in this, that according to circumstances it forms a free tube sunk in the sand, or perforates calcareous bodies, and its tube serves as a sheath or lining for the cavity which it inhabits: this species, then, under the circumstances first named, belongs to *Fistulana;* under the second, to *Gastrochæna.*

Fistulana pyrum. This M. Deshayes does not know completely; but judging from the form of its tube, he thinks that it very probably belongs to *Fistulana:* it may indeed, he adds, be possible that this is the same species (accidentally free) as that named *Pholas hians* by Brocchi; in that case it would be another example of the inutility of the genus *Gastrochæna.*

Fistulana clava, the only other species recorded in the last edition of Lamarck, is left without comment.



Fistulana clava. (Sowerby.)

1, Showing the tube with a septum, *a;* 2, outside of the valves; 3, inside of the same. (G. B. Sowerby, *Genera.*) N.B. Mr. Sowerby figures also a tube of this species without a septum.

Locality of *Fistulana clara,* East Indian seas.

The *Fistulanæ* inhabiting a free tube have been found in sands or hard mud, with the small end of the tube uppermost.

TUBI'FERA, the title of the fourth order of Polypiaria in the classification of Lamarck, including the Alcyonea of Lamouroux.

TÜBINGEN, the second capital of the kingdom of Würtemberg, is in 48° 32′ N. lat. and 9° 4′ E. long.: it is situated on the left or north bank of the Neckar, over which there is a stone bridge, at its confluence with the Ammer, in one of the most beautiful and fertile parts of the highland of Würtemberg. On both sides of the valley of the Neckar are mountains partly covered with forests; and rising above them, towards the east and south, the majestic forms of the neighbouring Alps, which, with the lovely valleys, and the gentle eminences covered with vineyards, make a most pleasant and at the same time magnificent landscape. The town itself, which is irregularly built in the old style, lies on a slope. The most regular portions are the two suburbs, one of which has been built within these few years on the right bank of the Neckar, and contains the handsomest houses. There are three Protestant and one Roman Catholic churches. The inhabitants, in number between 8000 and 9000, are partly employed in the manufacture of woollen cloths; but Tübingen is chiefly interesting on account of its university, which was founded in 1477, by Count Eberhard, who became afterwards the first duke of Würtemberg: it flourished during the first 40 years till the Reformation: Reuchlin and Melanchthon were among its professors. After the Reformation its professors, especially those of divinity, were highly esteemed by all the Protestants of Germany. It experienced in the sequel many vicissitudes of fortune. It was greatly improved in 17[illegible]. It remained entirely Protestant till 1803; when Elwangen and some territory being acquired by Würtemberg, the population of which professed the Roman Catholic religion, the university founded for them at Elwangen was suppressed, and the students admitted at Tübingen, which is now the only university in the kingdom. The university has six faculties, namely, medicine, jurisprudence, philosophy, Protestant and Roman Catholic divinity, and political economy. There are thirty professors in ordinary, who form the Senate, and six extraordinary. According to the new statute of 18th January, 1829, there is, instead of a rector, a chancellor, appointed by the king, who is at the head of the whole university and of the Senate in particular. The number of students is generally between 600 and 700 (Hörschelmann says that in 1832 there were 84[illegible] students). The university has ample funds; with a library of 60,000 volumes (according to the 'Conversations-Lexicon,' 140,000), a good collection of natural history, a cabinet of medals, a collection of mathematical, astronomical, and philosophical instruments, an observatory, and botanic garden. There are a Protestant and a Roman Catholic seminary, a clinicum, and an anatomical theatre. The library and many of the collections of the university are in an antient palace or castle called Hohen-Tübingen, which was formerly strongly fortified. The library is placed in a handsome apartment, 220 feet long and 50 broad, with convenient reading-rooms attached to it. Among the principal public edifices, besides the university, are St. George's church; the town-hall, built in 1435; the two seminaries; the museum, built in 1821; the court of justice of the circle of the Black Forest; the city hospital, a very spacious building; the Clinicum, founded in 1805, which is an infirmary and lying-in hospital, to which medical students are admitted for practical improvement. The town has several printing-offices, dyeing-houses, breweries, and manufactures of woollen cloth. Much wine is made in the neighbouring country, but it is not held in great estimation. There are many saw, fulling, and other mills on the Neckar and the Ammer. Trade is pretty brisk, the high road from the Black Forest into Switzerland passing through the town.

(Brockhaus, *Conversations Lexicon;* Stein's *Geographie,* by Horschelmann; Memminger, *Beschreibung von Würtemberg;* A. Fischer, *Das Königreich Würtemberg,* Stuttgard, 1838.)

TUBIPORÆA, or TUBIPO'RIDÆ, a group of Actinozoaria, forming the first family of the Zoophytaria of Blainville, the other families being Corallia, Pennatularia, and Alcyonaria. The Tubiporidæ are thus defined:—

Animals provided with internal ovaries, and eight pinnated

tentacula, and contained in elongated cylindrical cells; cells calcareous or coriaceous, with a round terminal opening, fixed by the base, and not united into a real common polyparium. (This last part of the characteristic is not clear.)

§ 1. Envelope fleshy.

Genus *Cuscutaria*, Blainville.

Tentacula regularly ciliated, contained in oval cells, attached alternately near the extremity of the articulations of a fistulous, rampant, tortuous stem.

This is equivalent to the British genus Walkeria of Fleming, or Sertularia cuscuta of Linn. Its place in this family seems doubtful. (*Wern. Trans.*, vol. iv., tab. 15, f. 1.)

Genus *Telesto*, Lamouroux.

Cells tubular, cretaceo-membranaceous, marked with eight longitudinal channels, and united into a ramose fixed polyparium.

Example, Telesto aurantiaca, Lam., pl. 7, f. 6.

Genus *Cornularia*, Lamarck.

Animals claviform. Cells infundibuliform, ascendent, open at the extremity, and continued inferiorly into an adherent mass. (Included by Lamarck and Lamouroux with the Sertulariæa.)

Example, Cornularia rugosa, Blainv. 'Actinologie,' pl. 82. fig. 4. Syn., Tubularia cornucopiæ, Linn.

Genus *Clavularia*, Quoi and Gaimard.

Animals oviform; cells tubular, elongated, subpedicellated, fixed, and agglomerated irregularly on the surface of marine bodies.

Example, Clavularia viridis, from Australasia. 'Actinologie,' pl. 82, f. 5.

§ 2. Envelope calcareous.

Genus *Tubipora*.

Animals cylindrical. Cells tubular, thin, membranaceous, enveloped in calcareous vertical tubes, which have round terminal openings, and are connected by transverse plates into an irregular (fixed?) polyparium.

Example, Tubipora musicalis, Linn. 'Actinologie,' pl. 62. f. 2.

TUBIPORITES. The fossil species supposed to belong to Tubipora are thus named by many writers on organic remains.

TUBULIBRANCHIATA. The *Tubulibranches* form Cuvier's second order of *Gastropods*, and he says that they ought to be detached from the PECTINIBRANCHIATA, to which however they very nearly approximate, because their shell, which is in the form of a more or less irregular tube, the commencement of which only is spiral, fixes itself upon various bodies: therefore, adds Cuvier, they have no organs of copulation, and fecundate themselves.

Cuvier's *Tubulibranches* consist of the genera *Vermetus*, MAGILUS, and *Siliquaria*.

Vermetus. (Adanson.)

The *Vermeti* have a tubular shell, the whorls of which, in the early age of the animal, form a kind of spire, but afterwards are prolonged into a tube more or less twisted or bent, like those of the tubes of *Serpulæ*. [TUBICOLÆ.] The shell is ordinarily fixed in an interlaced group of the same species, or partly enveloped in Lithophytes. As the animal does not creep, there is no foot properly so called; but that which in the ordinary gastropods forms the tail is bent downwards and carried forward in front of the head, where its extremity expands into a mass furnished with a delicate operculum which closes the entrance to the tube: it has sometimes various appendages, and its operculum is horny in some species. The head of the mollusk is obtuse, and carries two moderate tentacles, which have the eyes at the sides of their external base. The mouth is a vertical orifice, and beneath it is seen on each side a filament which has all the appearance of a tentacle, but which in reality belongs to the foot. Their branchiæ only form one row, along the left side of the branchial vault. The right side is occupied by the rectum and the spermatic chord, which also transmits the eggs. There is no penis, and the animal fecundates itself. (Cuvier.)

Cuvier remarks that the species are rather numerous, but not very distinct.

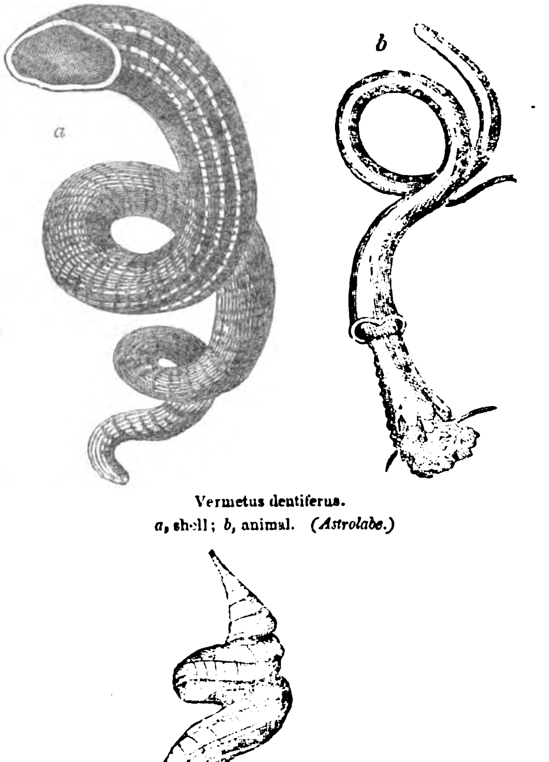
Linnæus placed the form under the genus *Serpula*.

Cuvier observes that Lamarck's *Vermilia*, which that zoologist still leaves near the *Serpulæ*, does not differ from the *Vermeti*.

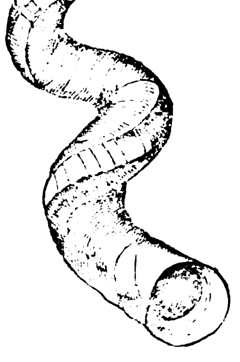
MM. Quoy and Gaimard are of opinion that these animals ought naturally to form an order apart, in consequence of the manner in which they construct their shell. Always fixed to the bodies on which they reside from their birth, they are not susceptible of any change of place. A motion of elevation and depression alone is permitted to them; and indeed the organization of some does not permit even that: such are those with an operculum whose foot is entirely masked by the body. Those which are deprived of it may be susceptible of creeping: they are hermaphrodites, having the two sexes united. The female organ only is visible; the other cannot so easily show itself. This disposition causes them to live ordinarily in groups, the eggs becoming fixed nearly on the spot where they are excluded; but they have been found isolated, a solitude probably due to particular circumstances, such as the agitation of the waves. Some have the commencement of a spire, the whorls of which rise perpendicularly; others fix themselves flat, and have only their extremity raised up. These mollusks have the faculty of abandoning the extremity of the spire and of mounting into the upper part of the shell in proportion as it grows.

The *operculum* is membranous, light, fragile, perfectly round, exceeding much the truncature of the foot, very concave, the elements of it close-set and confusedly spiral.

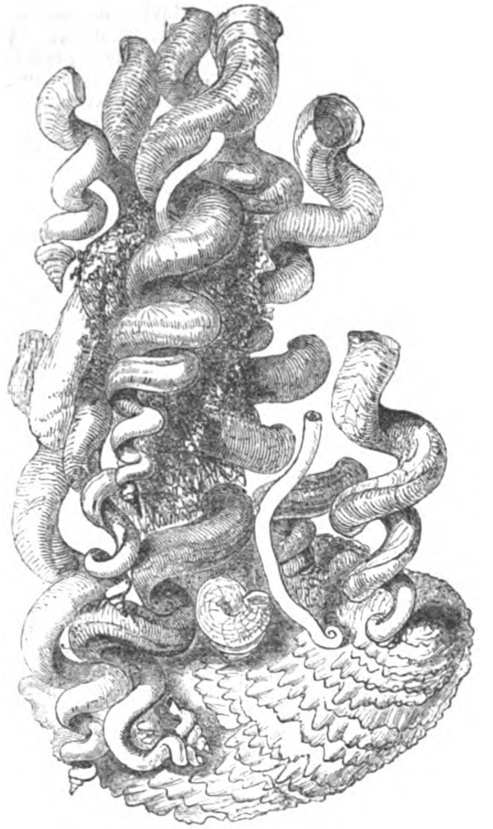
The mantle is open throughout the width of the body. The pulmonary cavity is very deep, and a long gill occupies all the left side: below it is a second rudimentary one, represented by a filament. The lamellæ of the great gill are filiform, rigid, and free, throughout a great portion of their extent. The rectum and the uterus, co-adapted together, open near the mantle to the right. A furrow leads from this last to the extremity of the foot, as in the



Vermetus dentiferus.
a, shell; *b*, animal. (*Astrolabe.*)



A single specimen of Vermetus lumbricalis, showing the spire.



Group of Vermeti, &c.

greater number of mollusks, whether diœcious or not. The follicles which secrete the mucus are placed, as ordinarily, near the rectum. The muscle which fixes the animal to its shell is long and strong, whence the vivacity of the motion which causes it to re-enter it. The liver occupies the extremity of the twisted portion, and along it run the organs of generation.. (*Astrolabe.*)

Locality of *Vermetus dentiferus*, New Holland, Shark's Bay, on an *Avicula*.

The number of species of *Vermetus* recorded by M. Deshayes in his tables amounts to eight living and one fossil (tertiary, from Angers). *Vermetus* occurs below the chalk: thus Dr. Fitton records six species, from the upper green-sand, the gault, the lower green-sand, Blackdown, and the Hastings sand.

The following are noticed by MM. Quoy and Gaimard (*Zoology of the Astrolabe*), in addition to *Vermetus dentiferus*,—*Vermetus Zelandicus*, *Verm. giganteus*, *Verm. carinatus*, *Verm. roseus*.

Vermeti have been found at depths varying from near the surface to twelve fathoms, in sponges, under stones, on shells, in coral-sand and sand.

Siliquaria. (Brug.)

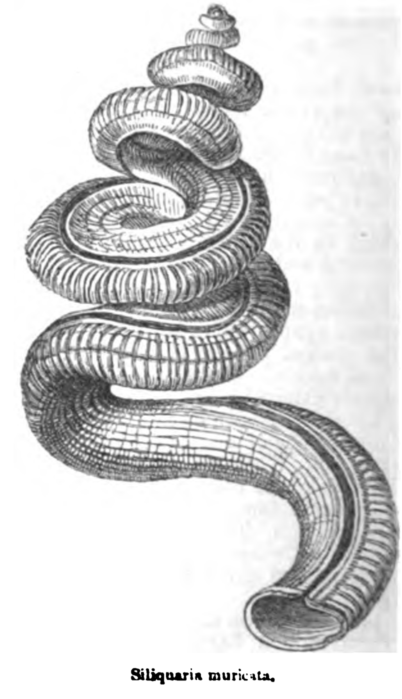
Cuvier remarks that *Siliquaria* resembles *Vermetus* in the head, in the position of the operculum, and in the tubular, irregular shell, which has, however, throughout its length a slit which follows all its windings, and which corresponds with a similar slit in the mantle which covers the branchial cavity. Along the whole length of this slit adheres a branchial comb, composed of a great quantity of foliations, distinct and, as it were, tubular. Linnæus placed them with the *Serpulæ*, and Cuvier observes that in these later times some have believed that they belong to the class of *Annelids*. Thus Lamarck supposed *Siliquaria* as well as *Vermilia* to be approximated to the *Serpulæ*.

Cuvier states that Audouin has observed and described the animal, and that to him he owes what he has said on the subject.

M. Milne Edwards, who refers to the labours of M. de Blainville and M. Audouin on this subject, remarks that the *Siliquariæ* first distinguished by Guettard under the name of *Tenagode*, and considered till of late as being Annelids closely approximating to the *Serpulæ*, belong to the class *Mollusca*, and should be placed near to the *Vermeti*. From the conformation of their tubiform shell, Savigny, he observes, had already expressed doubts as to the correctness of the generally received opinion on this point: and M. de Blainville went further, for he recognized the right of these animals to belong to the class of mollusks, a judgment which ulterior discoveries entirely confirmed. M. Audouin, having enjoyed an opportunity of observing one of these animals, has proved that their organization closely approximates that of the *Vermeti*. The body is of an elongated form and spirally turned, so that it cannot be extended in a straight line; anteriorly is seen the *operculum*, which is very thick, formed of the aggregation (empilement) of horny lamellæ, and fixed on a muscular foot, which presents superiorly a sort of appendage very much compressed backwards, from which rises a distinct head, furnished with two small tentacles slightly expanded at the summit, each provided at their base with a projecting eye. Immediately next to the head is seen the mantle, which is slit superiorly throughout its length to the base of the spiral part (tortillon), which is distinct and terminates the body. The right lobe of the mantle is reduced to a very narrow fringe, which is bordered within by a small furrow extended from the head to the origin of the *tortillon*; the left lobe is much larger throughout its extent. The branchiæ exist on one side only, and consist of simple filaments fixed to the internal surface of the left lobe of the mantle throughout its length. Finally, says M. Milne Edwards, the tortillon is somewhat short, and includes the liver and organs of generation, which terminate at a small notch on the left lobe of the mantle. The shell when recent is covered externally with a sort of epidermis, and its walls are fixed to foreign bodies with much less firmness than the shells of the greater part of the *Serpulæ*.

The number of species recorded in the tables of M. Deshayes are four living and one fossil (tertiary); and of these, *Siliquaria anguina* (*Serpula anguina*, Linn.) is noted as recent and fossil (tertiary). In the last edition of Lamarck's 'Animaux sans Vertèbres' are six recent species, including *Siliquaria australis*, which MM. Quoy and Gaimard found at Port Western in New Holland; and four fossil (including *Siliquaria anguina*) from the neighbourhood of Angers, from Grignon, and from the calcaire grossier of Néhou. Mr. Lea records *Siliquaria Clairbornensis* from the tertiary of Alabama.

Example, *Siliquaria muricata*. Locality, Indian Seas.



Siliquaria muricata.

Species of this genus have been found in sponges.

TUBULIPORA. [TUBULIPORIDÆ.]

TUBULIPO'RIDÆ, or TUBULIPORÆA, the second family of Polypiaria solida, in Blainville's arrangement of the Actinozoaria. The characteristics appear by no means exact; but are thus stated by Blainville:—

Animals contained in cells of a tubular figure, with a round mouth, which are accumulated irregularly, so as to form an attached unsolid polyparium. (The animals are only known in the genus Tubulipora.)

Genus *Microselena*, Lamouroux.

The cells accumulated in diverging fasciculi, so as to constitute a calcareous solid polyparium, generally hemispherical above and radiato-striate below.

Example, Microselena porosa, Lam. 'Gen. Polyp.,' pl. 7, f. 24-26. (Fossil at Caen.)

Genus *Obelia*, Lamouroux.

Cells conical, approximate, adherent at their origin, separated, and ascendent at their extremity, so as to form a small round attached plate-like polyparium.

Example, Obelia tubulifera, Lam. 'Gen. Polyp.,' pl. 80, f. 7 and 8. (From the Mediterranean.)

Genus *Tubulipora*, Lamarck.

Animals slender, elongate, hydriform, with eight tentacula. *Cells* deep, rather conical, agglomerated into a parasitical encrusting cretaceo-membranaceous polyparium.

Example, Tubulipora transversa, Lamarck. Ellis, 'Corallines,' tab. 27, fig. *e*, E. (Seas of Europe.)

Genus *Rubula*, Defrance.

Cells subcylindrical, prominent, irregularly united at the base into a calcareous echinulated (probably attached) polyparium.

Example, Rubula Soldanii, Defr. (*Dict. des Sci. Nat.*, tom. 46, p. 596.) (Fossil from Hauteville.)

TUCA'NUS (the Toucan). A southern constellation of Bayer, situated between Phœnix and the south pole, and near to the bright star in Eridanus. The principal stars are as follow:—

Character. (None in Bayer.)	No. in Catalogue of		Magnitude.
	Lacaille.	Astron. Society.	
α	1789	2651	3
δ	1799	2670	5
γ	1877	2774	4
η	1923	2862	5
ε	1926	2867	5
ζ	11	21	5
β^1	26	44	4
β^2	27	45	4
β^3	28	46	5

TUCKER, ABRAHAM, a distinguished metaphysician, was descended from a Somersetshire family, and was born on the 2nd of September, 1705. His father was an eminent merchant in London, who amassed a large fortune, and died in his son's infancy, leaving him to the guardianship of a maternal uncle, Sir Isaac Tillard. 'Of the memory of this relation,' says Sir Henry Mildmay, whose biographical sketch prefixed to his edition of the 'Light of Nature Pursued' is the only account that we have of this author, 'Mr. Tucker to the latest hour of his life never failed to speak with extreme affection and gratitude, frequently observing that he was indebted for every principle of honour, benevolence, and liberality which he possessed to the indefatigable pains and bright example of his uncle.' Tucker was sent to a school at Bishop's Stortford, and in 1721 entered as a gentleman commoner at Merton College, Oxford. During his stay at Oxford he devoted himself chiefly to metaphysical and mathematical studies, but found time also to make himself master of the French and Italian languages, and to cultivate a natural taste for music into very considerable skill. About the year 1724 he went to the Inner Temple, 'where for some time,' Sir Henry Mildmay informs us, 'he applied very closely to the law, in which he acquired such a degree of knowledge as enabled him to conduct with advantage the management of his own affairs, and frequently to render very essential service to his friends and neighbours; but his fortune not requiring the aid of a profession, to the pursuit of which neither his constitution nor his inclination was adapted, he was never called to the bar. While he continued at the Temple, he commonly passed the vacations in tours through different parts of England or Scotland, and once made a summer excursion into France and Flanders.'

In 1727 Mr. Tucker purchased Betchworth Castle, near Dorking, with an extensive estate attached. He immediately applied himself to the study of agriculture, and, 'with his usual industry, he committed to paper a great variety of remarks which he either had made himself, collected from his neighbours and tenants, or selected from different authors, both antient and modern, who have treated on rural economy.' In 1736 he married Dorothy, daughter of Edward Barker, Esq., of East Betchworth, cursitor baron of the exchequer and receiver of the tenths. He had two daughters by this lady, who died in 1754. The elder daughter, Judith, survived her father, and died unmarried in 1795. Dorothea Maria, the younger, married, in 1763, Sir Henry Paulet St. John, Bart., and was the mother of Sir H. P. St. John Mildmay, who assumed the name of Mildmay on a marriage with an heiress of that name, and who edited the 'Light of Nature Pursued,' and wrote the sketch of his grandfather's life, from which we have quoted.

Tucker felt the loss of his wife very severely, and occupied himself for some time in twice transcribing all the letters he had ever received from her. He then applied himself to educate his daughters, and himself taught them French and Italian. In 1755 he put together and arranged some materials which a friend had sent to him for the purpose, and published them in a pamphlet, with the name 'The Country Gentleman's Advice to his Son on the subject of Party Clubs.' Sir Henry Mildmay says of this pamphlet, which is very scarce, and of which he had with difficulty procured a copy, that it was not a party production, but a general exhortation, addressed chiefly to young men, against strong political feeling. We learn on the same authority that Tucker kept quite aloof from politics, and having been often solicited to be a candidate for the representation of Surrey, invariably refused. 'He was once only prevailed on to attend a county meeting at Epsom, where party ran very high; and though he took no active part in the proceedings there, he was introduced into a ludicrous ballad, where he is described, with several other gentlemen of respectability and talent, as confounded by the superior powers and eloquence of the Whigs of that day, Sir Joseph Mawbey and Sir Humphrey Coates. This circumstance afforded to Mr. Tucker abundant matter for humorous animadversion, and whenever politics were the subject of conversation he seldom failed to advert to the ill success of his only essay in public life; and was so much amused with the figure he made in verse, that he set the ballad to music.'

It was about the year 1756, according to Sir Henry Mildmay, that Tucker began his great work 'The Light of Nature Pursued;' at least no papers relating to it were found of an earlier date. But the materials for that work must have been long in course of collection, and it probably contains the results of the observation and reflection of a whole life. 'My thoughts,' says Tucker of himself, 'have taken a turn from my earliest youth towards searching into the foundations and measures of right and wrong; my love for retirement has furnished me with continual leisure, and the exercise of my reason has been my daily employment.' When he had determined upon composing his work, we are told by Sir Henry Mildmay that 'he made several sketches of the plan for his work (one of which he afterwards printed in the shape of a dialogue), before he finally decided on the method he should pursue; and after he had ultimately arranged and digested his materials, he twice transcribed the whole copy in his own hand.' And he endeavoured to improve himself in composition by a study of the principal Greek and Latin authors, and by translating the most admired passages of Cicero, Demosthenes, and others. The first specimen of his work was published in 1763 under the title 'Free Will:' this was a selection from the four octavo volumes of the 'Light of Nature Pursued,' which he gave to the world in 1765. In the mean time, a criticism in the 'Monthly Review' on the 'Free Will' led him to publish a reply, under the title 'Man in Quest of Himself; by Cuthbert Comment.' He published the 'Light of Nature Pursued' under the fictitious name of Edward Search. The remaining volumes of the work, the composition of which, together with magisterial duties and the superintendence of his estate, occupied the remainder of his life, were edited after his death by his daughter.

Sir Henry Mildmay gives the following interesting account of Mr. Tucker's habits:—'He always rose early in the morning to pursue his literary labours. During the winter months he commonly burnt a lamp in his chamber for the purpose of lighting his own fire. After breakfast he returned again to his studies for two or three hours, and passed the remainder of the morning in walking, or in some rural exercise. As he was remarkably abstemious, he lost but little time at the table, but usually spent the early part of the evening in summer in walking over his estate, collecting information on all agricultural subjects from his tenants, and committing the result of their practical experience to paper. In winter he completed the regular measure of his exercise by traversing his own apartment, and, after accomplishing the distance he had allotted to himself, he employed the remainder of the afternoon in reading to his daughters.' In 1771 blindness overtook him, a fever having completed what incessant application had prepared the way for. 'His favourite object however was not abandoned in consequence of this calamity, his mechanical ingenuity enabling him to direct the construction of a machine, which guided his hand and helped him to write so legibly that his productions were easily transcribed by an amanuensis.' He also received invaluable aid from his elder daughter, whom Sir Henry Mildmay not unjustly compares to Milton's daughter. 'She transcribed the whole of his voluminous work for the press; and so entirely did she devote her time, like Milton's daughter, to those pursuits which would make her most useful to her father, that she applied herself to the study of the Greek language, in which she made such proficiency as to be enabled to preserve to her father, during the remainder of his life, an intercourse with his favourite authors, of which his misfortune must otherwise have deprived him.' Tucker died in 1774.

Tucker's work is one which for various reasons, its length as well as the nature of the subject, is read by few; but many will know the praise bestowed on it by Paley in the preface to his 'Moral and Political Philosophy:'—'There is however one work to which I owe so much that it would be ungrateful not to confess the obligation: I mean the writings of the late Abraham Tucker, Esq., part of which were published by himself, and the remainder since his death, under the title of "The Light of Nature Pursued, by Edward Search, Esq." I have found in this writer more original thinking and observation upon the several subjects that he has taken in hand than in any other, not to say than in all others put together. His talent also for illustration is unrivalled. But his thoughts are diffused through a long, various, and irregular work. I shall account it no mean praise if I have been sometimes able to dispose into method, to collect into heads and articles, or to exhibit in more compact and tangible masses, what, in that otherwise excellent performance, is spread over too much surface.'

The 'Light of Nature Pursued' is a desultory work, and not a systematic treatise, on mind and morals, and is of a practical rather than a theoretical character. The principles of mental and moral science are but cursorily treated, and with the view of being applied to the business and practical exigencies of man's life. Tucker adopts Hartley's theory of association, with its objectionable material elements; but instead of *association* he always uses the term *translation*, a term which has nothing to recommend it in preference to that which he discards. The striking qualities of Tucker's work are ingenuity and fertility of illustration, a rich quiet vein of humour, which has procured for him the title of 'the metaphysical Montaigne,' and a lofty moral aim, which renders the work as useful to the student as its humour and variety of illustration render it generally entertaining.

Tucker was a favourite author with Sir James Mackintosh, who has evidently bestowed great pains upon his sketch of him. 'He had many of the qualities which might be expected in an affluent country gentleman, living in a privacy undisturbed by political zeal, and with a leisure unbroken by the calls of a profession, at a time when England had not entirely renounced her old taste for metaphysical speculation. He was naturally endowed, not indeed with more than ordinary acuteness or sensibility, nor with a high degree of reach and range of mind, but with a singular capacity for careful observation and original reflection, and with a fancy perhaps unmatched in producing various and happy illustration. The most observable of his moral qualities appear to have been prudence and cheerfulness, good-nature and easy temper. The influence of his situation and character is visible in his writings. Indulging his own tastes and fancies, like most English squires of his time, he became, like many of them a sort of humourist. Hence much of his originality and independence; hence the boldness with which he openly employs illustrations from homely subjects. He wrote to please himself more than the public. He had too little regard for readers, either to sacrifice his sincerity to them or to curb his own prolixity, repetition, and egotism, from the fear of fatiguing them. . . . He was by early education a believer in Christianity, if not by natural character religious. His calm good sense and accommodating temper led him rather to explain established doctrines in a manner agreeable to his philosophy than to assail them. Hence he was represented as a time-server by freethinkers, and as a heretic by the orthodox. . . . . Had he recast without changing his thoughts,—had he detached these ethical observations, for which he had so peculiar a vocation, from the disputes of his country and his day,—he might have thrown many of his chapters into their proper form of essays, which might have been compared, though not likened, to those of Hume.' (*Dissertation on the Progress of Ethical Philosophy*, Whewell's edition, p. 268.

The best edition of the 'Light of Nature Pursued' is that of Sir Henry Mildmay, in 7 vols. 8vo. There is a reprint of this edition in 2 vols. 8vo., 1837. An abridgment of the work has been published by Mr. Hazlitt, which is now out of print, but which is highly commended by competent judges. The tract in reply to the 'Monthly Review,' of which the full title is 'Man in Quest of Himself, or a Defence of the Individuality of the Human Mind or Self,' is printed in Parr's 'Metaphysical Tracts,' published by Lumley, 1837.

TUCKER, JOSIAH, D.D., a learned divine and distinguished political writer of the last century, was born at Laugharne in Carmarthenshire, in 1711. Some time afterwards his father went to reside on a small estate near Aberystwith in Cardiganshire, which had become his property and which he cultivated himself, having been brought up as a farmer. Although his means were very small, he contrived to send his son to Ruthin School in Denbighshire, where he pursued his studies with such success as to be enabled to obtain an exhibition at St. John's College, Oxford. In those days it was a matter of some difficulty to perform the journey between Wales and Oxford, and it is said that young Tucker was obliged to go backwards and forwards on foot, with a stick over his shoulder and a bundle at the end of it. On one occasion his father mounted him upon his own horse, but the young man did not wish to sacrifice the convenience of his father to his own pride, and in future journeys he resumed his stick and his bundle. Shortly after leaving the university he entered into holy orders, and served the curacy of All Saints, Bristol. He next became curate of St. Stephen's Church, Bristol, and was appointed a minor canon in the cathedral of that city. Here he had the good fortune to engage the friendship and esteem of Dr. Butler, the bishop of his diocese, who appointed him as his domestic chaplain, and afterwards obtained for him a prebendal stall in the cathedral of Bristol. To the active friendship of his excellent patron he was also indebted for the rectory of St. Stephen's, to which he succeeded in 1749. To complete at once the history of his ecclesiastical preferments, we will add that in 1758 he became dean of Gloucester, and about the same time took his degree of D.D.

To his residence in the great commercial city of Bristol may, in great measure, be ascribed the prevailing character of his political writings, the best of which are those which relate to the interests of trade and commerce. Passing over for the present such of his publications upon other subjects as may intervene in point of time, we shall be the better able to give a connected view of his principal writings upon trade. In 1748 he published his first commercial work, entitled 'A Brief Essay on the Advantages and Disadvantages which respectively attend France and

Great Britain with regard to Trade, with some Proposals for removing the Principal Disadvantages of Great Britain, in a new method.' In this essay he condemned the French system of taxation, especially the taille, the duties upon salt, and those laid upon provisions entering their great cities. He objected also to their mode of farming the revenue, to their *maîtrises* or guilds, and to their monopolies and exclusive charters. Nor did the taxes of this country escape his censure. 'The taxes upon the necessaries of life are in fact so many taxes upon trade and industry; and such must be accounted the duties upon soap, coal, candles, salt, and leather. Likewise the duties upon the importation of foreign raw materials, to be employed in our own manufactures, are so many fetters and chains to prevent the progress of labour and the circulation of wealth.' He denounced 'our monopolies, public companies, and corporate charters,' as being 'the bane and destruction of a free trade.' Amongst the most important of his proposals for improving the trade of Great Britain may be mentioned a union with Ireland in all respects, as to parliament, trade, and taxes; an extension of our inland navigation; and the adoption of a system of warehousing goods on importation, at the option of the merchant. At that time we had very few canals; a prejudice existed against them; and more than twenty years after the publication of this essay we find a canal bill opposed in parliament as tending to injure the coasting-trade, and as being 'greatly prejudicial to that most important object, the nursery and increase of seamen.' (Cavendish's *Debates*, 15th Feb., 1769, vol. i., p. 337-9.) A system of warehousing, it is well known, had been proposed by Sir Robert Walpole in 1733, and abandoned on account of the storm of opposition which it encountered. Nor did the ignorance and prejudices of the merchants allow this valuable measure to be carried into effect for more than half a century after the dean of Gloucester had most plainly pointed out its advantages. His arguments and illustrations upon this point are hardly susceptible of improvement after forty years' experience of the practical effects of this system. [WAREHOUSING SYSTEM.]

In 1774 he first published a tract which he had written sixteen years before, entitled 'A Solution of the Important Question, whether a Poor Country, where Raw Materials and Provisions are Cheap and Wages Low, can Supplant the Trade of a Rich Manufacturing Country, where Raw Materials and Provisions are Dear and the Price of Labour High.' The subject is very ably treated, and (as is usually the case with the dean) in a plain and practical manner. This tract is well worthy of attention, as the question is still one of great interest, and a frequent subject of discussion in reference to free trade and our competition with foreign manufactures.

'The Case of going to War for the Sake of Trade, considered in a new Light,' is another valuable tract, first published in 1763, and republished with the last. It is an enlightened exposition of the evils of war in regard to trade, and of the folly of engaging in the one for the sake of promoting the other. M. Turgot thought so well of this tract, that he translated it into the French language, and wrote a very complimentary letter to the author. Some years later he published a work upon a similar plan, viz. 'Cui Bono? or an Enquiry what Benefits can arise either to the English or the Americans, the French, Spaniards, or Dutch, from the greatest Victories or Successes in the Present War; being a Series of Letters addressed to Monsieur Necker.' It laboured by argument and by familiar illustrations to show the impolicy of war, and to discourage jealousy and exclusiveness in national commerce.

But the most remarkable of all the commercial tracts of Dean Tucker was published in 1785, being 'Reflections on the Present Matters in Dispute between Great Britain and Ireland.' The object of this tract was to point out the advantages that might be derived from the commercial freedom of Ireland, and to suggest to the English merchants a scheme for evading restrictions and monopolies, by the use of the free Irish ports for their commercial adventures. The ends proposed to be accomplished by these means were:—1st, 'A free trade, for the benefit of both kingdoms, to all the countries beyond the Cape of Good Hope;' in other words, an escape from the commercial monopoly of the East India Company: 2ndly, 'A free trade to Egypt and the Levant,' at that time restricted by the charter of the Turkey Company: 3rdly, 'A free importation of sugars and of other products of the warmer climates, from the cheapest market, wherever it can be found:' 4thly, 'A free navigation, exempted from those clogs and restrictions which are required by the famous Act of Navigation;' and 5thly, 'The free exportation and importation of grain.' It is interesting to observe that the first of these objects was not attained until 1833, nor the second until 1825; that the fourth has only been partly realised; and that the third and fifth are still unaccomplished, and still the theme of active political discussion.

Even this brief notice of Dr. Tucker's commercial views will serve to rank him amongst the highest of the political writers of the last century, for it must be recollected that when he commenced his inquiries the genius of Adam Smith had not yet enlightened the world. The 'Wealth of Nations' was not published until 1776, and the course of lectures from which were developed the foundations of that great work did not begin sooner than 1752, or four years after the publication of Dr. Tucker's 'Essay on Trade;' nor are we aware that any of Adam Smith's lectures at Glasgow appeared in print before the publication of the 'Wealth of Nations.' The value of Dr. Tucker's smaller tracts and essays upon trade makes it a subject of regret that he did not complete a more methodical and scientific work which he had undertaken. This work was commenced at the desire of Dr. Hayter, bishop of Norwich, and preceptor to the Prince of Wales, afterwards George the Third. The circumstances connected with this work may be best explained in the words of the author:—'His lordship's design was to put into the hands of his royal pupil such a treatise as would convey both clear and comprehensive ideas on the subject of national commerce, freed from the narrow conceptions of ignorant or the sinister views of crafty and designing men.' 'I therefore entered upon the work with all imaginable alacrity, and intended to entitule my performance the Elements of Commerce and Theory of Taxes; but I had not made a great progress before I discovered that such a work was by no means proper to be sheltered under the protection of a royal patronage, on account of the many jealousies to which it was liable, and the cavils which might be raised against it. In fact, I soon found that there was scarcely a step I could take but would bring to light some glaring absurdity which length of time had rendered sacred, and which the multitude would have been taught to contend for as if their all was at stake. Scarce a proposal could I recommend for introducing a free, generous, and impartial system of national commerce, but it had such numbers of popular errors to combat with as would have excited loud clamours and fierce opposition.' For these reasons he laid the scheme aside, and, unfortunately for his own fame and for the interests of mankind, he never resumed it.

While the concerns of trade were thus engaging his attention, other measures of public policy aroused his interest and exercised his pen. But we cannot fail to observe, in reading his various publications, that the principles of free trade and the improvement of our commercial laws were never absent from his mind.

In 1751 a bill was brought into the House of Commons for the naturalization of foreign Protestants, and after passing through its other stages was lost on the third reading. This circumstance gave rise to two very able pamphlets, in which the dean contended strongly for the measure.

Three years before, in his 'Essay on Trade,' he had proposed to encourage the settling of foreigners in this country as one of the means of increasing our wealth and advancing our trade and manufactures; and on the rejection of the bill he published 'Reflections on the Expediency of a Law for the Naturalization of Foreign Protestants,' in two parts. In these he gave a most lucid and complete historical review of the laws with regard to foreigners from the earliest time; and treated with severity and ridicule the jealous and illiberal conduct of the English with regard to other nations. His arguments in favour of inducing foreigners to give this country the benefit of their skill and capital, and his enlightened analysis of our history, in reference to their exclusion, are among the very best of his writings. He was soon called upon to exert himself again in the same cause. In 1753 a bill was brought into the Lords to permit Jews to be naturalized by parliament, a privilege from which they had been excluded by an act of the 7th James I. (c. 2), chiefly directed against the Papists, and which required all persons applying for naturalization to have taken the sacrament of the Lord's Supper. This bill was violently opposed in both houses of parliament, and throughout the country, but being supported by the ministers, at length received the royal assent. No sooner had it become the law than the clamours with which it had been assailed were redoubled, and while they were at their height, Dr. Tucker boldly undertook the defence of the measure in two 'Letters to a Friend concerning Naturalizations.' The act was nowhere more unpopular than at Bristol, and the populace were so enraged at his opposition to their prejudices, that they burned him in effigy in full canonicals; and he is said to have witnessed the ceremony from his own garden. The violence of public feeling upon the subject at that time may be judged of from the facts that on the last day of the winter session, in the same year, the Duke of Newcastle was forced to move for the repeal of the act, and that the obnoxious measure was actually repealed.

At the very commencement of the disturbances in the American colonies, the dean took a view of British interests at variance with all parties, and published several tracts from time to time as the contest proceeded. He showed no sympathy with the Americans, nor did he acknowledge the justice of their complaints. On the contrary he vindicated the constitutional right of the mother country to tax her colonies, and accused the Americans of ingratitude in resisting the mild and liberal sway of England. Thus far he agreed with the court party; but while they urged coercion and punishment, and while the opposition were seeking to conciliate and make concessions, Dr. Tucker proposed to abandon the colonies altogether. He did not doubt the power of England to coerce the Americans, but he asked, in 'A Letter from a Merchant in London, to his Nephew in America,' 'How are we to be benefited by our victories? And what fruits are to result from making you a conquered people? Not an increase of trade; that is impossible: for a shopkeeper will never get the more custom by beating his customer; and what is true of a shopkeeper is true of a shopkeeping nation.' To these opinions he always adhered, and took every occasion to enforce them. Writing so late as 1782, he stated that he had held the opinion for upwards of five and twenty years that colonies were detrimental to a country, and that he had been 'growing every day more and more convinced.' These views were consistent with his uniform advocacy of perfect freedom of trade and navigation; and were strengthened by his horror of the needless wars which had too often been caused by distant colonial possessions.

The warmth of the controversy led him to speak with much acrimony of the American people, their leaders and advocates, and some of his statements brought him into collision with Mr. Burke, who treated him with great disrespect. 'This Dr. Tucker,' he said in his celebrated speech on American taxation (April 19, 1774), 'is already a dean, and his earnest endeavours in this vineyard will, I suppose, raise him to a bishopric.' In consequence of this reference to himself, the dean addressed his next pamphlet, in the form of a letter, to Mr. Burke, and dissected the speeches of that statesman upon the American question, and again enforced his own opinions.

His views of the American question led him frequently to oppose the doctrines laid down by Mr. Locke, and relied upon by the Americans—that the consent of the governed, given either by themselves or by their representatives chosen by them, is the only foundation of civil government and the only justification of taxes. In many of his pamphlets he combated these principles, and at length devoted an elaborate work to their refutation. In 1781 his 'Treatise concerning Civil Government' appeared. It consists of three parts. In the first he examines the doctrines of Mr. Locke, and of his followers, Dr. Price, Dr. Priestley, and Mr. Molyneux, as to the principles of civil and political liberty. In the second he offers a theory of his own as the true basis of civil government, and suggests alterations in the British constitution. In the last he describes the former Gothic or feudal constitution of England, chiefly in order to show the gradual increase of popular power and the limitation of the influence of the crown. The work evinces much acuteness and learning, but is of a somewhat desultory character. His opinions were decidedly adverse to any extension of popular representation, and he even proposed to raise the qualification of electors and of the members of the House of Commons. He had printed the greater portion of this work some years before, for private circulation amongst his friends, and it was actually quoted and attacked before it was published.

The devotion of his talents with so much ardour to political and commercial inquiries laid him open to many sarcastic imputations of neglecting his spiritual duties. His bishop especially, Dr. Warburton, between whom and the dean there seems to have been much want of cordiality, was alleged to have said that 'his trade was his religion, and his religion a trade.' The dean took many opportunities of refuting these calumnies, and exposing the injustice of the prejudice with which his labours were regarded. On one occasion he thus expressed himself:—'The bishop affects to consider me with contempt: to which I say nothing. He has sometimes spoken coarsely of me: to which I replied nothing. He has said that religion is my trade and trade is my religion. Commerce and its connections have, it is true, been favourite objects of my attention, and where is the crime? And as for religion, I have carefully attended to the duties of my parish, nor have I neglected my cathedral. The world knows something of me as a writer on religious subjects; and I will add (which the world does not know), that I have written near three hundred sermons, and preached them all, again and again. My heart is at ease on that score; and my conscience, thank God! does not accuse me.' In the preface to 'Reflections on the Expediency of a Law for the Naturalization of Foreign Protestants,' he complains that he had 'undergone some censures for engaging in inquiries seemingly beside his profession;' and 'he begs leave to offer some reasons for his interfering in those matters, and at the same time to vindicate himself from the supposition of having deserved the ill-treatment he has met with.' He states that 'in his parish, though large and populous, he performs all the offices of his function himself, according to the best of his abilities;' and therefore 'flatters himself that as long as he follows these studies without neglecting his other engagements, and delivers his opinions in an inoffensive manner, he shall be excused in the judgment of all candid persons, though the warmth of party zeal, or the resentment of those whose interest clashes with that of the public, may excite them to vilify and insult him.' Three years later, he writes, 'Another bill brought against me is that I am extremely ignorant in my peculiar profession as a divine; and that having dedicated too much of my time to the study of commerce, I have shamefully neglected to cultivate those sciences which more immediately belong to my clerical profession. To these charges I stand mute; and as my Apology for the Church of England, my Sermons, and my Letters to the Rev. Dr. Kippis, are now before the public, let the impartial judge as they please.'

It is not surprising that the political works of so able a writer should have attracted more public notice than his ministrations in the church, or even his published sermons and religious treatises; but it would be doing gross injustice to his memory not to mention with praise the zeal and learning displayed by him in the cause of religion. In none of his political writings did he show more ability than in his 'Apology for the present Church of England,' and his 'Letters to Dr. Kippis.' In these he maintained the right and duty of the church to regulate the behaviour of its own members in such things as relate to the ends of its own institution; and thus he supported the practice of enforcing subscription to the Thirty-nine Articles on the part of the clergy. But at the same time he claimed the fullest indulgence for dissenters, and showed the mistaken policy of penal laws against ecclesiastical nonconformity. He published another valuable tract upon the same subject in 1774, entitled 'Religious Intolerance no Part of the General Plan either of the Mosaic or Christian Dispensation.' At about the same time he published 'Seventeen Sermons on some of the most important Points of Natural and Revealed Religion.' He proposed also to revise the Book of Common Prayer, to retrench its redundancies and repetitions, and to reduce its length; but he does not appear to have proceeded with this design.

As a political writer Dr. Tucker proved himself a man of uncommon sagacity, judgment, and foresight, with a mind little tainted by prejudice, and very far in advance of his age. As a divine he would unquestionably have enjoyed a higher reputation, if his religious writings had not been eclipsed by the greater celebrity and interest of his political works. His style is clear, simple, and forcible; and his mode of treating a question rather popular than scientific. His principles and maxims, indeed, are always expressed in a concise and logical form, and the arrangement of his subject is methodical; but the freedom of his style and the familiarity of his illustrations impress his writings with a character essentially popular.

His numerous publications have never been collected, and are now extremely scarce. Many of them passed through several editions, and attracted a large share of public interest, both in this country and on the Continent. Their celebrity would most probably have continued until this day with greater lustre, had not Adam Smith since raised a beacon to political economists in his 'Wealth of Nations,' by which all direct their course, and beyond which none care to explore.

In private life Dr. Tucker was an amiable and pious man. In his own parish he was deservedly loved and respected. His income was never large, but his wants were few, and he dispensed his charities with a liberal hand. An anecdote is related of him which reflects great credit upon his heart. His curate at St. Stephen's, Bristol, was much esteemed by Dr. Tucker, and had a large family to support with very limited means. The dean conceived the project of resigning the rectory in his favour, and after much solicitation and interest, he persuaded the chancellor, in whose gift it was, to accept his resignation, and bestow the living upon his friend. He then resided almost entirely at the Deanery in Gloucester. Late in life he married Mrs. Crowe, his housekeeper. He died on the 4th November, 1799, at the advanced age of eighty-eight, and was interred in the south transept of the cathedral at Gloucester.

(*Gentleman's Magazine*, 1799, vol. 69; Seward's *Anecdotes;* Tucker's various tracts and treatises.)

TUCKEY, CAPTAIN. [CONGO.]

TUCUMAN. [PLATA, vol. xviii., p. 220.]

TUDE'LA. [NAVARRA.]

TUDE'LA, BENJAMIN OF. [BENJAMIN.]

TUDOR. [HENRY VII.]

TUDWAY, THOMAS, doctor in music, a name well known in musical history, but more on account of his connection with the lord high treasurer Harley and of his conversational talents, than for any productions of his pen that have survived him. He was educated in the King's chapel, under Dr. Blow, and was a fellow-pupil of Purcell. In 1671 he became organist of King's College, Cambridge, and in 1705 was honoured by a doctor's degree in that university, and also appointed the professor of music. After which Queen Anne named him as her Organist and Composer Extraordinary. He now was much patronised by the Oxford family; and the valuable scores of English church music, in many volumes, in the British Museum, were collected by him for Lord Oxford, and form part of the Harleian Collection, No. 7337, *et seq.* There is a tradition that, with Prior, Sir James Thornhill, and other eminent persons, 'he formed a weekly society at the house of the lord high treasurer. Thornhill drew all their portraits in pencil, and Prior wrote humorous verses under each. These passed into the possession of Mr. West, formerly president of the Royal Society.' A portrait of Dr. Tudway is in the music-school at Oxford. He composed anthems and a few other works; but except one of the former, published in Dr. Arnold's 'Collection of Cathedral Music,' we have never met with any one of his productions.

TUESDAY. [WEEK.]

TUFA. [TRAVERTIN.]

TUFF. The accumulations of scoria and ashes about a volcanic crater, which are re-aggregated so as to make a coherent or solid mass, are termed volcanic tuff. Similar but more antient aggregations of the products of heat, re-aggregated into firm, solid, or even highly compact rock, are called trap tuff. One mode of occurrence of volcanic tuff among the products of a recent volcano is represented by Mr. Lyell, *Princ. of Geol.*, book iv., chap. 6.

TUILERIES. [PARIS.]

TULA, a government of European Russia, is situated between 52° 53′ and 54° 56′ N. lat. and 35° 54′ and 38° 50′ E. long. It is bounded on the north by Moscow, on the east by Riasan, on the south-east by Tambow, on the south by Orel, and on the west by Kaluga. The area is 11,200 square miles, and the population 1,115,000.

This country is a uniform undulating plain, where hardly anything is to be seen but boundless cornfields or meadows, traversed by low hills, with little wood, no large lake, no considerable river, in short no remarkable natural scenery, but on all sides the active industry of man, this province being one of the best cultivated and most populous in this vast empire. The soil is dry, and generally poor, and owes its fertility to skilful cultivation. The principal river is the Oka, which comes from Kaluga, and partly forms the boundary towards Moscow and Kaluga. The Don, which rises in lake Ivanof, near the frontiers of Riasan, is little more than a brook in its short course in this government before it enters that of Riasan. There is however no want of water, there being above 200 small rivers. 'The inhabitants,' says Hassel, 'are Russians, with a few German families living among them; the peasants are a depressed race, born to obey, quiet, docile, and industrious as long as they are under due restraint, but obstinate, indolent, and quarrelsome where they have their will. On the whole they are poor; so indigent that they frequently require the assistance of their lord; their clothing and food inconceivably wretched; they rarely have meat, more rarely fish, and many never buy salt.'

The bishop of Tula and Bjelew is at the head of the clergy; he has 857 parishes under him. The government is divided into twelve circles. Except in the capital there are no manufactories; woollen and linen are made only for their own use by the families of the country-people.

The most considerable town next to the capital, Tula, is Bjelew, situated on the Oka, in the western part of the government. It is a large old town, with a rampart and moat: it has fifteen churches; one monks' convent, with a seminary for 60 students; a nunnery; and several public buildings. The population probably exceeds considerably 7000, that number having been assigned to it twenty years ago. There are several tanneries, breweries, tallow-melting houses, and manufactories of hardware, especially knives, which are highly esteemed all over Russia. The inhabitants carry on a considerable trade. Wenew, on the Wenewka, which falls into the Ortes situated 32 miles north-west of Tula, has eight churches and 3500 inhabitants. There is a silk manufactory, a soap manufactory, and some breweries. Odojew, on the Upa, has seven churches and 3300 inhabitants, who derive subsistence from agriculture, mechanical trades, and a considerable commerce in hemp and corn with Kaluga. Jefremow, on the Metscha, has six churches built of wood and one of stone. Most of the houses are thatched with straw. The inhabitants, 3000 in number, chiefly subsist by agriculture. The above are the only chief towns of circles that require any special notice.

TULA, the capital of the above government, situated in 54° 15′ N. lat. and 37° 25′ E. long., at the confluence of the Tulitza and the Upa, is an important commercial and manufacturing town. It has 51,000 inhabitants, 28 churches, two monasteries, with a seminary and a gymnasium, 17 poorhouses, a theatre, a foundling hospital, and a house of correction: there is likewise an institution, called the Alexandrium, for the education of children of noble families. The manufactory of arms is the most extensive and important in the Russian empire. It was founded by Peter the Great in 1712, and belongs to the crown. It employs above 7000 workmen, of whom 600 are smiths; has two iron-foundries, and provides the whole army with arms, producing annually 70,000 muskets and 25,000 side-arms, which are of excellent quality and beautiful workmanship; cutlery of various kinds is also manufactured here. There are in Tula numerous tanneries and breweries, manufactories of Russia leather, candles, soap, beet-root sugar, and great tallow-melting houses, which produce annually two million pounds of tallow, besides manufactories of woollens, linen, sealing-wax, paint, and Prussian blue. There is a very great trade in all these articles, as well as in corn and hemp. The two annual fairs are much frequented. The city suffered severely by two fires in 1834.

(Hassel, *Handbuch;* Cannabich, *Lehrbuch der Geographie;* Brockhaus, *Conversations Lexicon; Russian Official Journals.*)

TULIP-TREE, the English name of the *Liriodendron tulipifera*, a tree belonging to the natural order Magnoliaceæ: in America, where it is a native, it is also known by the names White wood, Canoe wood, Saddle-tree, Tulip-bearing Lily-tree, Virginian Poplar, and the Poplar. The name Liriodendron is formed from *leirion* (λείριον), 'a lily,' and *dendron* (δένδρον), 'a tree,' the flowers resembling those of a lily, or more correctly a tulip, as its specific name implies. The botanical characters of the genus are as follows:—carpels 1-2 seeded, disposed in spikes, indehiscent, deciduous, drawn out into a wing at the apex; calyx of three deciduous sepals; corolla of six petals forming a bell-shaped flower. There is but one species of the genus, the *L. tulipifera*, which is a handsome tree with large four-lobed truncate leaves resembling a saddle in shape, and large elegant flowers coloured with green, yellow, and orange. There are three varieties of this tree described: the *L. t. obtusiloba*, which has its leaves with blunter lobes than the original species, and on account of the yellowness of the wood is called Yellow Wood or Yellow Poplar. The *L. t. acutifolia* has the leaves smaller and more acutely cut than the other varieties. The *L. t. flava* is known by its flowers being entirely yellow.

This tree is one of the most magnificent inhabitants of the forests of the temperate parts of North America. According to Michaux, the northern limit of this tree is the southern extremity of Lake Champlain, in 45° N. lat., and its eastern limit is the Connecticut River, in 72° W. long. It abounds in the middle states of the North American union, in the upper parts of the Carolinas and of Georgia, and is still more abundant in the western country, particularly Kentucky. These trees sometimes attain a height of 120 feet or more, and their trunks measure 20 feet in circumference. The most common dimensions however are from 70 to 100 feet in height, and from 18 inches to three feet the diameter of the trunk.

It is uncertain at what period the tulip-tree was introduced into Europe. In England it was cultivated by Compton at Fulham in 1688. Evelyn, in his 'Sylva,' referring to it, says, 'They have a poplar in Virginia with a very peculiar-shaped leaf, which grows well with the curious among us to a considerable stature. I conceive it was first brought over by John Tradescant, under the name of the tulip-tree from the likeness of its flower; but it is not, that I find, taken much notice of in any of our herbals. I wish we had more of them, but they are difficult to elevate at first.' They are now planted very generally in Europe, having a geographical range from Berlin and Warsaw on the north, to the shores of the Mediterranean and Naples on the south, Ireland on the west, and the Crimea on the east. In this country many of the trees have attained a height of 70 or 80 feet, and a circumference of the trunk of six or seven feet. The trees blossom in Great Britain, but do not ripen their seeds, although they do in many parts of the Continent.

The timber of the tulip-tree is seldom used in Europe, as the tree is too much valued as an ornament; but in America, where it is so abundant, it is found to yield a light, compact, fine-grained wood, which is useful for many purposes. It is easily wrought, and receives a good polish. It is used by cabinet and coach makers, for making furniture and the pannels of carriages. The Indians of the West country prefer this tree for the construction of their canoes. In America the bark of this tree has a reputation as being a substitute for the cinchona bark; and in 1792 Dr. Young of Philadelphia published a paper on its remedial agency, in the 'American Museum.' The bark has a bitter and an aromatic taste, properties which probably depend, as in other barks, on the possession of an alkaloid and an essential oil, but it does not yet appear to have been chemically examined.

The best mode of propagating the tulip-tree is by seeds, which should be obtained from the native country of the tree. These should be sown in heath soil, very fine mould, or sandy loam, and kept moist in a shady situation. When the seeds are sown in autumn, they mostly come up the following spring; but if they are not sown till the spring, they remain a year in the ground. The varieties of this plant may be propagated by budding, grafting, or inarching. This tree does not bear transplanting well, nor the use of the pruning-knife.

(Loudon, *Arb. et Frut. Brit.*, vol. i.; Don's Miller, vol. i.)

TULIP. [TULIPA.]

TU'LIPA, a genus of plants belonging to the natural order Liliaceæ. This name is a corruption of the Persian word *thoulyban*, or *toleban*, which is the name the plants of this genus bear in Persia. The Persian word also signifies a turban, and was probably applied to the tulip on account of the resemblance between the form of the flower and that article of dress. The genus is known by its perianth being composed of six sepals. The stigma is three-lobed; the seeds are smooth, and it has neither nectary nor style. All the species are herbaceous plants developed from a bulb; the flowers are mostly solitary, seated on a lengthened scape, at the base of which the leaves, not numerous, are developed. About thirty species have been described.

T. sylvestris, the Wild Tulip, has the stem 1-flowered, somewhat drooping; the leaves of the perianth ovato-acuminate, hairy at the extremity, the stamens hairy at the base. This is the only species of tulip that is a native of Great Britain. In England it occurs in the counties of Norfolk, Suffolk, Hertfordshire, and Middlesex, in a chalk soil. It has also been found in Scotland. It is found in the southern parts of Germany, in Switzerland, Italy, and France. It has yellow flowers, and blooms in April and May. It increases itself by throwing out a long stout fibre from its root, at the extremity of which a bulb is developed, and thus a new individual is produced at a considerable distance from the parent plant.

T. Oculus Solis, the Agen Tulip, has a 1-flowered glabrous stem; oblongo-lanceolate leaves; the stamens smooth; the exterior leaves of the perianth acuminate, the interior ones obtuse. This species was not known to Linnæus, and was first distinguished by St. Amans. It was found at Agen in France, and also grows wild in Italy, Germany, and other parts of Europe. The flowers are large and bell-shaped, of a fine scarlet-red colour, each petal marked with a broad black yellow-edged spot at its base. It blossoms in April and May.

T. suaveolens, the Early Dwarf or Van Thol tulip, has the stem single-flowered, downy; the flower erect; the leaves of the perianth obtuse, smooth; leaves of the stem ovato-lanceolate. This plant is supposed to be a native of the south of Europe. It blooms in March and April. It is cultivated in Holland under the name of *Duc Van Thol*. The flowers are of a scarlet colour, edged with yellow, and give out a sweet scent, for which this plant is more cultivated than on account of the colour or form of its flower. The plants are small, and if cultivated in a room, in sand or earth or water, may be made to blossom as early as January.

T. Celsiana, Small Yellow Tulip, has a solitary, mostly erect, flower; the leaves of the stem lanceolate; leaves of perianth greenish, lanceolate; the stamens slightly hairy above the base. This plant blossoms in March or April, and is a native of the south of Europe, and of the banks of the Wolga. It was known to Clusius, Bauhin, Magnol, and Tournefort, but Linnæus confounded it with the wild tulip. It is not however more than half the size of that plant. It has been found near Toulon and Montpellier and Narbonne in France, and was restored amongst the number of species of the tulip by Redouté, who has figured it in his splendid work on the Liliaceæ.

T. Clusiana, Red and White Italian Tulip, has a smooth 1-flowered stem; the leaves of the stem linear-lanceolate; leaves of the perianth acute. This tulip was confounded by Linnæus with the Tulipa Gesneriana. It is about the size of the wild tulip, and was at one time known under the name of *T. persica præcox*. Redouté restored this species as well as the last, and figured it in his work. It was at one time supposed to be a Persian plant, but it has been found wild near Toulon in France, and also in Italy and Sicily.

T. biflora, the Two-flowered Yellow Tulip, has a stem bearing two or three flowers with two spreading lanceolate leaves. This plant is a native of the salt deserts about the Wolga, and is found in company with *T. celsiana*. It is not more than half the size of that plant, and blossoms earlier, and has less duration. The flowers are fragrant.

T. Gesneriana, Common Garden Tulip, has the stem 1-flowered and smooth, as well as the petals and filaments; the flower erect, the leaves ovato-lanceolate, glaucous and smooth; the lobes of the stigma decurrent and deeply divided. Of all the species of tulip this one is the best known, and has perhaps had more attention bestowed upon it than any other plant that produces only flowers. This species of tulip grows wild in the Levant, and appears to have been cultivated by the Turks in their gardens from an early period. Busbequius, who was the first who cultivated this plant in Europe, found it growing wild between Adrianople and Constantinople; and Shaw found it in Syria between Jaffa and Rama, and at Chardin. Those which were cultivated in Constantinople were brought from Cavala and Caffa; the former being early-flowering sorts, and the latter late-flowering. Busbequius brought bulbs with him from Constantinople, for which he says he paid a considerable price, and grew them in his garden as early as 1554. Conrad Gesner was the first to describe the tulip, which he did in 1559, in his edition of the works of Valerius Cordus, from some tulips he had seen blooming in a garden at Augsburg. It seems to have been introduced into England about 1577; for Gerarde, in his 'Herbal,' published in 1597, has the following account of the tulip:—

'My loving friend, Master James Garrett, a curious searcher of simples and learned apothecary in London, hath undertaken to find out, if it were possible, the infinite sorts by diligent sowing of their seeds, and by planting those of his own propagation and by others received from his friends beyond the seas for the space of twenty years, not being yet able to attain to the end of his travaill, for that each new year bringeth forth new plants of sundry colours not before seen: all which to describe particularly were to roll Sisyphus' stone, or number the sands.'

The tulip was first introduced into France in 1611. It does not appear at what time it was first carried to Holland, but the Dutch were early in the habit of sending to Constantinople for tulip-seeds. It was in this country that the tulip was destined to make the greatest impression. In the early part of the seventeenth century the passion for the possession of these plants became so strong, that dealing in them became one of the most important money speculations, and the bulbs of tulips were sold and resold at enormous prices, in the same manner as stocks are on the Stock Exchange of England. It became in fact a gambling transaction, in which persons ventured their capital, in the hope that particular kinds of tulips would realise a higher price. This practice was not carried on throughout Europe, but was confined to the Netherlands, and rose to its greatest height in the years 1634, 1635, 1636, 1637. Beckmann, in his 'History of Inventions,' gives an account of this remarkable tulipomania, as it was called. One variety of tulip, called the Viceroy, was exchanged for articles valued at 2500 florins.

'These tulips,' says Beckmann, 'afterwards were sold according to the weight of the roots. Four hundred perits (a perit weighs nearly a grain) of Admiral Liefken cost 4400 florins; 446 ditto of Admiral van der Eyk, 1620 florins; 106 perits Schilder, cost 1615 florins; 200 ditto Semper Augustus, 5500 florins; 410 ditto Viceroy, 3000 florins, &c. The species Semper Augustus has been often sold for 2000 florins; and it once happened that there were only two roots of it to be had, the one at Amsterdam, the other at Haarlem. For a root of this species one agreed to give 4600 florins, together with a new carriage, two grey horses, and a complete harness. Another agreed to give twelve acres of land for a root. Those who had not ready money promised their moveable and immoveable goods, house and lands, cattle, and clothes.' Munting mentions a man who won by this trade in tulips more than 60,000 florins in the course of four months. 'It was followed not only by mercantile people, but also by the first noblemen, citizens of every description, mechanics, seamen, farmers, turf-diggers, chimney-sweeps, footmen, maidservants, and old clothes-women. At first every one won and no one lost. Some of the poorest people gained in a few months houses, coaches and horses, and figured away like the first characters in the land. In every town some tavern was selected which served as a Change, where high and low traded in flowers and confirmed their bargains with the most sumptuous entertainments. They formed laws for themselves, and had notaries and clerks.' But the object of these speculations was not a desire to possess the plants themselves, although the first purchasers were prompted by that feeling. 'During the time of the tulipomania, a speculator often offered and paid large sums for a root which he never received, and never wished to receive. Another sold roots which he never possessed or delivered. Oft did a nobleman purchase of a chimney-sweep tulips to the amount of 2000 florins, and sold them at the same time to a farmer; and neither the nobleman, chimney-sweep, nor farmer had roots in their possession or wished to possess them. Before the tulip season was over more roots were sold and purchased, bespoke and promised to be delivered, than in all probability were to be found in the gardens of Holland; and when Semper Augustus was not to be had, which happened twice, no species perhaps was oftener purchased and sold. In the space of three years, as Munting tells us, more than 10,000,000 florins were expended in this trade, in only one town of Holland.' Such a system was nothing more than gaming on a large scale, and although all seemed to gain at first, the time soon came when the tulip purchasers failed to meet the demands made upon them, and as many became ruined as had previously made their fortunes. The Dutch government found it necessary to interfere, and, in 1617, decreed that every vender should offer his tulips to the purchaser, and in case he refused to receive them, the vender should either keep them or sell them to another, and have recourse to the purchaser for any loss he might sustain. Thus fell the gambling or great tulipomania of Holland, but the ardent love of the flower, from which this curious mania arose, still continued, and has ever since maintained the greatest influence over the Dutch and Flemish floriculturists.

Of all the plants which have obtained attention on account of the beauty of their flowers, perhaps tulips have had the most. In estimating the excellence of a particular flower, the florist is not so much guided by its beauty of form and colouring, as by its rarity; and sorts which have at one time obtained great prices on account of their rarity have become little thought of when they became more abundant. There are however several points considered by florists as essential to the character of a fine tulip. 'The stem should be strong, elastic, and erect, and about 30 inches above the surface of the bed. The flowers should be large, and composed of six petals (*phylli*): these should proceed a little horizontally at first, and then turn upwards, forming almost a perfect cup, with a round bottom, rather widest at the top. The three exterior petals should be rather larger than the three interior ones, and broader at their base; all the petals should have perfectly entire edges, free from notch or serrature; the top of each should be broad and well-rounded: the ground colour of the flower, at the bottom of the cup, should be clear white or yellow, and the various rich-coloured stripes, which are the principal ornament of a fine tulip, should be regular, bold, and distinct on the margin, and terminate in fine broken points elegantly feathered or pencilled. The centre of each leaf or petal should contain one or more bold blotches or stripes, intermixed with small portions of the original or breeder colour, abruptly broken into many irregular obtuse points.' (*Cyc. of Gard.*)

The varieties of cultivated tulips have been divided by florists in many ways for the sake of convenience. Parkinson, who wrote in 1629, enumerates 140 varieties, which were divided into *præcoces*, early blowers; *serlinæ*, late blowers; and *dubiæ mediæ*, doubtful or middle blowers. The first division consisted principally of varieties of *Tulipa suaveolens*. The latter divisions were chiefly composed of varieties of *T. Gesneriana*. Amongst modern florists in Great Britain, the varieties of the latter tulip, of which upwards of 600 are enumerated in modern catalogues, are divided into four families—Bizarres, Byblœmens, Roses, and Selfs.

Bizarre tulips have a yellow ground marked with purple or scarlet of different shades. *Byblœmen tulips* have a white ground, lined, marked, striped, or variegated with violet or purple only of various shades. *Rose tulips* are marked or variegated with rose, scarlet, crimson, or cherry colour on a white ground. *Selfs*, or *plain-coloured tulips*, are those which have a white or yellow ground without any marks. The three first of these families are again divided into *feathered* and *flamed*, according as the intermingled colours are in narrow stripes or pencillings, or in a broad central stripe.

It is from amongst the last family of tulips, the *Selfs*, that what are called *breeders* are selected. In a state of nature the tulip is mostly a self, that is, it has but one colour; but under certain circumstances all the other colours that are found in tulips will be developed in these simple-coloured tulips. It is thus that the vast variety of tulips have been obtained that at present exist, and as each variety can be propagated by offshoots from the parent bulb, and as the colours of tulips will admit of an infinity of modes of blending, there is hardly a limit to the number of varieties of these flowers which may be obtained. Selfs are always raised from seeds, but the circumstances which are most favourable to the 'breaking' of the Selfs, as the development of other colours is called, are not well understood. A florist will have to wait sometimes twenty years without having the pleasure of seeing his self 'break.'

To develop all the beauty of form and colour of which the tulip is susceptible, requires the greatest care in its cultivation, and perhaps it is only amongst the amateurs of Holland and Belgium that this flower can be seen in all its glory. Tulips are mostly planted in beds, which should be made in an open, airy situation. The soil should be dug out for about 20 inches deep, and the bed filled in with a mixture of about two parts of a fresh, rich, loamy soil, rather of a sandy character, and one part of well-rotted cow-dung. The best time for planting the bulbs is from the end of October to about the tenth of November. They should be planted about seven inches apart and about four inches deep, or less according to their size, in the ground. The leaves will appear in February, and the blossoms in April or May. The bed of flowers is often protected by an awning, which should not be used till the flowers are opened, and should be so constructed that the light and air may be freely admitted during the intervals between the coolness of the night and the brightness of the sun at noonday. Tulips should never be artificially watered. When the petals fall off, the seed-vessel should be removed, as its remaining on weakens the bulb. When the top of the stem begins to wither and dry up, and the leaves become brown, the bulbs should be taken up and placed in a dry situation. In the following August or September the loose skins and fibres and the easily separable offsets should be taken off the bulbs, and they should be deposited in drawers. In propagating the tulip from seeds they should be sown in deep boxes, filled with good garden-mould mixed with sand. The young plants will not require water, and they may be expected to blossom by the fourth or fifth year, or at latest the seventh.

(Loudon, *Cyclopædia of Plants; Cyclopædia of Gardening;* Miller's *Dictionary of Gardening; Diction. des Sciences Naturelles;* Beckmann's *History of Inventions;* Paxton's *Botanical Dictionary;* Redouté, *Liliacées;* Hogg, *Supp. to Practical Treatise,* &c.)

TULIPA'RIA. [SERTULARIDÆ; POLYPIARIA.]

TULIPOMA'NIA. [TULIPA.]

TULL, JETHRO, a gentleman of moderate fortune, who lived in the beginning of the last century, and zealously devoted a great part of his life to the improvement of agriculture. He possessed a small estate near Hungerford, on the borders of Oxfordshire and Berkshire, and has generally been considered as the father of the drill and horse-hoeing husbandry. Having observed the good effects of the cultivation of many plants in regular rows, and of frequently stirring the intervals between them, as has been done from time immemorial by gardeners, he attempted to introduce this system into the field, and invented many ingenious implements for diminishing the labour of hand-drilling and hoeing. The success which attended his first experiments, on a good deep loam, confirmed his expectations, and led him to a theory, which was the cause of his own ultimate ruin, and threw discredit on the whole system, which in other respects was founded on sound principles. Observing that, by means of assiduous cultivation and stirring of the soil around the roots of growing plants, he produced a greater luxuriance of growth than by the common methods, without any addition of manure for several years, he concluded rashly that the earths very finely divided, together with moisture, constituted the whole of the food of plants, and that, consequently, stirring and pulverizing the soil was a complete substitute for manuring. Having fully established this erroneous principle in his own mind, he exerted all his ingenuity to effect the most complete pulverization of the soil. In the first place all the seeds were to be sown in rows at such a distance that a plough or other stirring-instrument drawn by a horse might conveniently be used in the intervals. From this circumstance his system was called the horse-hoeing husbandry. The immense advantage which would arise from the cultivation of waste lands in distant parts of the kingdom, if the increased labour of men and horses were a perfect substitute for manure, where it could not well be procured, made many clever men look upon Tull's system as a most wonderful discovery; and the first trials appeared to be so successful, that the *new husbandry,* as it was called, was strongly recommended for general adoption.

The great reluctance with which any new system is adopted by the mass of practical farmers prevented the new husbandry from becoming universal; and only some men of a theoretical turn fully adopted the notions of Jethro Tull. All those who persevered in the practice of it, neglecting to recruit their lands by a judicious addition of manure, found to their cost that, however good crops they might have for a time, by continually stirring and pulverizing the soil, it became totally exhausted at last, so as to produce a barrenness, which required a long course of expensive manuring to remove, and was the cause of serious ultimate loss. Tull himself, who adhered to his principles to the last, like most original inventors, and expended large sums in experiments, and in the construction of a variety of new and ingenious implements, became so embarrassed that he lost all his property, and it is said, died in prison, where he had been put by some merciless creditor. (*British Husbandry,* 'Farmer's Series of the Library of Useful Knowledge,' published by the Society for the Diffusion of Useful Knowledge.)

The unhappy fate of the author of the system, and the loss sustained by its principal abettors, threw such a discredit upon it, that for a long time not even the most useful part of it was retained. Had Tull introduced the row culture, as it is practised in Lombardy, from which he borrowed some of his principal operations, and joined judicious manuring with his horse-hoeing, he would have had the merit of originating, in England, at least, the greatly improved system of drill-husbandry which has since been generally adopted wherever it can be conveniently executed; and the sowing of seeds broad-cast would have long since been confined to artificial grasses, which, being intended for pasture, cannot grow too closely together. The cleaning of the soil from weeds, and the exposure of a great part of the surface to the influence of the atmosphere, would have entirely superseded fallows, and a proper application of manure would have kept up the fertility.

Tull published a treatise on his new mode of cultivation in 1731, in which his principles were explained and calculations made, founded on his early experiments of the immense profit which would accrue in the course of years by adopting his practice. Change of crop would be no longer necessary; rotations useless; the most profitable crops could be raised year after year without diminution, and the soil be kept in a state of perpetual fertility. Such were the visions of a man of considerable abilities, led into error by his own sanguine imagination. Had the soil of Tull's farm been of a poor gravelly or sandy nature, he would soon have discovered his error by a few experiments; but working on a good deep loam, and continually keeping it stirred and pulverized, it required a much longer time to exhaust it; but at last it was completely exhausted, and the owner was ruined.

The fate of Tull and his system may be a warning to those who are fond of building ingenious theories on a few imperfect experiments, and a caution to wait till the facts are fully established before they draw practical conclusions from them.

Jethro Tull first published, in 1731, detached essays on his new mode of cultivation, which were afterwards, in 1751, collected into one volume, with copious notes by himself.

In 1822 the late Mr. Cobbett edited a new edition of Tull's works, with an introduction by himself, which, like everything written by that perspicuous writer, is full of useful remarks. Cobbett fully appreciated the value of the practical part of Tull's system, and strongly recommended it in his 'Cottage Economy.' He showed there, by reference to actual experiments in a garden, how greatly the stirring of the soil around the roots of growing plants assisted their growth, and the advantage of allowing a certain space to every plant to admit of this stirring. Tull had cultivated roots with great success according to his system; and as long as the organic matter in the soil was not exhausted, the success fully proved the correctness of his practice. The greatest obstacle which Tull had to contend with was the obstinacy of his labourers, who thought him quite mad when he ordered them to sow only two rows ten inches apart on a stitch of land four feet six inches wide, leaving forty-four inches between each double row for the working of the plough. He was forced to put his hand to the plough himself; and in this as well as in his other trials he was greatly assisted by the encouragement and actual help of Lord Ducie of Moreton, whose descendant, the earl of Ducie, is now one of the most zealous and active patrons of all improvements in agriculture, having established a model farm at Whitfield, Gloucestershire, and invented several useful implements of tillage. Whatever may have been the errors of Tull in hastily adopting an erroneous theory, he has many excuses in the received opinions of his time. Van Helmont's experiment of the willow prepared the minds of scientific men for the theory that water alone was sufficient for all the purposes of vegetation; and Tull seems to have supposed some *pabulum* in the ultimate particles of earth, which with water furnishes all that the soil requires to produce active vegetation; and when we consider that by the most recent experiments it has been fully proved that four gases—oxygen, hydrogen, carbonic acid, and azote or nitrogen—with a very small proportion of earth, form the whole elements of vegetable and animal substances, it is not so great an error to suppose that air, water, and earth, which contain all these elements, may be sufficient for vegetable or animal increase. This was the whole error of Tull.

TULLAMORE, or TULLAMOORE, a town in the barony of Ballycowan, in King's County, in the province of Leinster in Ireland, 63 miles west by south of Dublin, in 53° 15′ N. lat. and 7° 28° W. long.

No historical interest attaches to this place, which, before 1790, when it was nearly destroyed by fire, was an insignificant village. Having been rebuilt by the proprietor, the earl of Charleville, after the conflagration, in a superior manner, and being in the centre of a fertile district, it rose in importance; and the circumstance that the Grand Canal for some time had its termination here, before it was carried on to the Shannon, promoted the growing prosperity of the place. Tullamore contained, in 1831, 1052 houses, inhabited by 1314 families, 45 houses uninhabited, and 14 houses building: the population was 6342. There are a neat market-house, a handsome county court-house, and a county gaol on the radiating principle; a small barrack for the military, and a police-station. There is a bridge over the little river Clodagh, which passes through the town and flows into the Brosna, a feeder of the Shannon; and there are several stores on the Grand Canal, which passes the town on the north side, and opens a communication with Dublin on the east, and with Limerick and other places on the Shannon on the west. The town is in the parish of Kilbride (the whole population of which, in 1831, was 9673): the parish church, in which divine service is performed on Sunday and Wednesday morning, is at some distance from the town; but divine service is performed on Sunday and Friday evening in the market-house. There is a Roman Catholic chapel in Tullamore; and there are in the parish meeting-houses for Quakers and Wesleyan and Primitive Methodists. The earl of Charleville has a capacious mansion, and an extensive and beautiful demesne adjacent to the town.

The market is held on Tuesday and Saturday: it is the greatest market in the county for grain: the average yearly sale for the ten years from 1826 to 1835 was estimated at 45,000 barrels of wheat, of 20 stones to the barrel; 35,000 barrels of oats, of 14 stones to the barrel; and 20,000 barrels of barley, of 16 stones to the barrel. There are five yearly fairs. Brick-making, distilling, and brewing are carried on.

The assizes for the county are held here, having been transferred from Philipstown by an act of 2 & 3 Wm. IV., c. 60. Quarter-sessions for the division are also held here. Tullamore is the residence of the sub-inspector of the county constabulary. The county infirmary is in the town.

The benefice of Kilbride is a rectory, the gross yearly income of which is 148*l.* 0*s.* 8*d.*, the net yearly income 117*l.* 6*s.* 11*d.*, with a glebe-house. The parish is in the diocese of Meath, and in the ecclesiastical province of Armagh.

There were in Kilbride parish, according to the Second Report of the Commissioners of Public Instruction (*Parl. Papers for* 1835, vol. xxxiv.), twenty day-schools of all kinds, with 1406 children (737 boys and 669 girls) on the books, and with an average daily attendance of from 900 to 950. Of these schools, two, with an average attendance of 280 boys and 200 girls, were in connection with the National Board, and were partly supported by local subscription; one, with 60 children in attendance, above two-thirds of them boys, was in connection with the London Baptist Hibernian Society; one, with 35 boys, was chiefly supported by Lady Charleville; and another, with 40 girls, was partly supported by a committee of ladies: the rest were private schools, some of them boarding-schools, affording instruction of superior kind.

(Lewis's *Topographical Dictionary; Parliamentary Papers; Dublin Almanack.*)

TULLE, a town in France, capital of the department of Corrèze, 248 miles in a direct line south by west of Paris, or 292 miles by the road through Orléans, Châteauroux, Limoges, and Uzerche; in 45° 16′ N. lat. and 1° 46′ E. long.

Tulle appears to have risen in the seventh century on the decay of a more antient town, the importance of which is testified by the remains of an amphitheatre, and by the marble busts, urns, vases, and other antiquities which have been discovered. Baluze considered this antient town to be the Ratiatum, or Ratiastum ('Ρατίατον, or 'Ρατίαστον) of Ptolemy, which D'Anville fixes in the district of Retz near the mouth of the Loire. The town of Tulle grew up under the protection of a Benedictine abbey which was early established here. It is built on the right bank of the Corréze, a stream belonging to the system of the Garonne, partly at the foot, partly on the slope of a hill, so steep that many of the houses are built against the sides of the hill. It is a dirty town, and the steepness of the streets presents a great impediment to its traffic. The principal buildings are the cathedral, formerly the Conventual church of the Benedictine abbey; the prefect's residence, the palais de justice or court-house, the prison, and the theatre. There are a pleasant public walk and good baths. The population of the commune of Tulle was, in 1826, 8479; in 1831, 8689 (of whom 6501 were in the town itself); and in 1836, 9700. There is a government manufactory of fire-arms established at Tulle, the iron for which is procured from Le Grênerie in the department of Dordogne, the steel from St. Etienne in the department of Loire, the coal from Laplau in the department of Corrèze, and the walnut-tree wood for the stocks from the departments of Lot and Corréze. Paper, playing-cards, hats, common woollens, leather, nails, walnut-oil, and liqueurs are made; and considerable trade is carried on in these and other articles. There are twelve fairs, one of which is a large horse-fair, and continues three days.

Tulle has a public library of 2000 volumes, a seminary for the priesthood and a high school, to which last is attached a collection of philosophical apparatus. Courses of instruction are given in practical geometry and mechanics. There is an hospital, one department of which is for the insane. Tulle was the native place of Etienne Baluze, the historian and antiquary.

The bishopric of Tulle was established in the fourteenth century: the diocese comprehends the department of Corrèze, and the bishop is a suffragan of the archbishop of Bourges.

The arrondissement of Tulle comprehended, in 1833, one hundred and eighteen communes, and had, in 1831, a population of 126,532: it is subdivided into twelve cantons, or districts, each under a justice of the peace.

(Malte-Brun, *Géographie Universelle; Dictionnaire Géographique Universel.*)

TULLUS HOSTI'LIUS, the third king of Rome, reigned from B.C. 673 to 641. He is called a grandson of Hostus Hostilius, who fell in a battle against the Latins in the reign of Romulus. His reign is described as the very reverse of that of his predecessor, the pious and peaceable Numa, and he himself as even more warlike than Romulus. After the death of Numa, the government was for a short time in the hands of interreges, until Tullus Hostilius was elected in the comitia of the Populus, and his election confirmed by the Senate. The most memorable event of his reign is the war with Alba, which is celebrated in antient story on account of the single combat between the Horatii and Curiatii, and which was followed by the destruction of Alba, and the establishment of the Roman plebs. The whole detail of the war cannot be regarded as historical, and has all the appearance of a poetical tradition. It is said to have arisen from predatory incursions which the Albans made into the territory of Rome, and the Romans into that of Alba. That there had existed a friendly relation between the two towns before is implied in the statement that the Horatii and Curiatii were related; and even now war might have been avoided, if it had not been for the cunning and the warlike character of Tullus, who forced the Albans to it. The Albans encamped four miles from Rome, and the trench which their king (dictator) Cluilius is said to have formed was the beginning of the Fossa Cluilia. He died during this invasion, and was succeeded by the dictator Mettus Fuffetius. The hostile armies had been arrayed against one another for a long time, when at last the Alban dictator proposed that the war should be decided by a single combat. The fight of the Horatii and Curiatii accordingly brought the war to a close, and Alba recognised the supremacy of Rome, and promised to furnish its contingent to the Roman armies. The formulæ of the Fetial law, and the trial of one of the Horatii for having slain his sister, contain some genuine and important documents of the olden time of Rome. (Livy, i. 24-26.) In the war of Tullus Hostilius against Fidenæ, which was supported by Veii, Mettus Fuffetius, according to the treaty between the two states, joined the Roman army with his troops, but with the design of abandoning his ally, and going over to the enemy at the critical moment. Tullus Hostilius discovered the treachery, and after the Fidenates and Veientines were vanquished, he punished the treacherous dictator, by having him torn in pieces by two chariots to which he was fastened, and at the same time he sent out his legions with orders to destroy the town of Alba, which, with the exception of its temples, was accordingly razed to the ground. The inhabitants of Alba were transferred to Rome, where the Cælian hill was assigned to them as their habitation. Several of the noble Alban families were incorporated with the Roman patricians, and the number of Roman equites was likewise doubled, while the great mass of the Alban population were treated as an inferior race, and formed the Roman plebs. [Rome.] When Tullus Hostilius had thus strengthened his kingdom, a war arose between the Romans and the Sabines, in which the Sabines were defeated near the Silva Malitiosa. But after these successful undertakings the gods afflicted Rome with a pestilence, which was preceded by several awful prodigies. The king however continued his warlike pursuits, until at last he was seized with the disease. In order to propitiate the gods, he consulted the Commentarii of Numa, which contained rules about the manner in which the wrath of the gods was to be appeased. He found the formula with which Numa had performed his solemn sacrifices to Jupiter Elicius. Tullus Hostilius attempted to do the same, and to call down the god, but he committed a mistake in his use of the sacred formula, and the god in his anger destroyed the king and his whole house by lightning.

This is the story of Tullus Hostilius as related by Livy (i. 22-32), which bears much more traces of a genuine tradition than the detailed and interpolated account in Dionysius (iii. 1, &c.). Respecting explanations of the story, see Niebuhr, *Hist. of Rome*, i. 246, &c.; Malden, *Hist. of Rome*, p. 127, &c.

TUMBREL, or TUMBRIL, a machine formerly used for the punishment of scolding women, consisting of a stool or chair attached to the end of a long pole, mounted in such a manner that the chair, with the offender placed in it, might be swung over a pond, and immersed as often as might be necessary. Several notices of the use of this apparatus, which was also called a *trebuchet*, a *cucking-stool*, or a *ducking-stool*, are given in Brand's 'Popular Antiquities,' art. 'Cucking-stool.' It appears to have been used as early as the æra of the Saxon government in England, and to have been a common punishment in some places at least as late as the time of Gay, who mentions it in his 'Pastorals.' The tumbrel was also used as a punishment for brewers and bakers who transgressed the laws relating to them. Fabian (quoted in Strutt's 'Horda Angel-cynnan,' vol. ii., p. 9) says that, in the 42nd year of Henry III., bakers were, for 'lack of size,' punished by the *tomberell*, whereas before that time they used to be punished by the pillory; and he adds, that the tomberell was 'a kind of pillorye, made foure-square, that turned round about.' The name tumbril is also applied to the covered carts used to carry tools, &c. in a train of artillery.

TUMEN, TJUMEN, or JEPANTSCHA, the chief town of a district of the same name in the government of Tobolsk in Asiatic Russia, is remarkable as being the first town founded by the Russians in Siberia. It was built in 1586, on the site of a Tartar town, of which some traces still remain. It is situated in 57° 10′ N. lat. and 65° 35′ E. long., on the right or south bank of the river Tura (which is much higher than the left bank), at its confluence with the Tumenka. The town is of considerable extent, chiefly consisting of wooden houses, above which some stone buildings rise, as well as the steeples of several churches, of which there are ten, besides a mosque and two convents. The environs consist of corn-fields and meadows. The number of inhabitants is above 8000, of whom 600 are Tartars. The banks of the Tura are interesting on account of the quantity of elephants' teeth which are there found not only at Tumen, but farther up the river, and which are in such a good state of preservation, that combs and other articles are made from them. Erman says that on the banks of the Suwarysch, a small river, not only teeth, but other bones of elephants are found, and also those of buffaloes.

(Cannabich, *Lehrbuch*; Stein, *Lexicon*; Stein, *Handbuch*, by Hörschelmann; A. von Humboldt, G. Ehrenberg, and G. Rose, *Reise nach dem Ural und dem Altai*; Erman, *Reise durch Nord Asien*, &c.)

TUMOUR. It is not possible to define exactly the diseases which are commonly classed under the name of Tumours, and any definition in which the character of *swelling* (which is the true meaning of tumour) is included is unnatural: for there are several diseases which agree in the most important respects with some of those called tumours, but are not attended by any obvious enlargement or swelling of the part in which they are situated, and the same disease exists in some cases with, and in others without, swelling. The greater part of the diseases which have been classed as tumours are examples of a large class of what may be called morbid or parasitic growths; diseased structures, which are not mere alterations of previously existing parts, but new organisms or living substances which have grown within the tissues of the body by powers of development peculiar to themselves, and which depend upon the surrounding parts only for their supply of blood or other nutritive fluid. In this class are included all those diseases described as solid or sarcomatous tumours, and those which are closely related to some kinds of tumours, but are not accompanied by swelling, such as tubercle, certain forms of diffused cancerous growths, and some others.

The diseases called Encysted Tumours are entirely different from all others of the class in their pathological characters, and will be considered in a separate article. [Wen.] The chief cancerous growths have been already treated of under their appropriate heading [Cancer, Melanosis]; and tuberculous growths under the name of the disease which is consequent on their development. [Phthisis.] The present article will be chiefly devoted to the history of those morbid growths which are commonly described as innocent tumours.

All morbid parasitic growths may be divided into *malignant* and *innocent*. The practical distinction between the two classes, from which they derive their names, is that an innocent growth or tumour is not likely to recur after being removed by operation, but a malignant growth is likely to recur in the same or some other part. These two names may safely be retained to mark the two chief divisions of morbid growths; for although the test of the result of a surgical operation cannot be applied to those which from their locality do not admit of extirpation, yet the names indicate important characteristics in the progress of the two kinds of growth, wherever seated. Independently of the practical distinction, the most essential characters of malignant growths are: 1st. That they may occur in almost any part of the body, although some parts are more liable than others, and each kind of growth seems to find its most appropriate seat in a certain organ, as cancer in the breast, tubercle in the lungs, melanosis in the liver, &c. 2. That they have a tendency to infect the adjacent parts, and to propagate themselves from one part to another, probably by germs carried from the primary disease into the blood, with which they circulate till they meet with an organ in a fit state to supply them with the means of increase. 3. That they tend, through an intermediate process of softening (which appears to be consequent on the death of their constituent particles), towards ulceration; that this ulceration is of a kind which is at present incurable; and that in its progress it involves almost without distinction of tissue all the adjacent natural structures of the body, the particles of which, by their contact or combination with those of the malignant growth, seem first to assume a nature similar to their nature, and then to perish with them. 4. That in general the minute structures of which they are composed are dissimilar to those of the natural organs of the body; and that their development does not proceed to the formation of any structure similar to the fully developed tissues.

The distinctive characters of innocent growths are chiefly negative. Certain of them may present one, but they rarely present more than one, and never all, of the characters just described. Thus: 1. The number of tissues in which innocent growths occur is comparatively few: in many parts in which malignant growths are common they are never seen; and when, as sometimes happens, many innocent tumours exist in the same body, they are (at least as a general rule) all found in the same tissue, or in or near the same organ. Thus, many fatty tumours may grow at the same time, but they all lie in the tissue of the natural fat: many fibrous tumours may occur together, but all are in or near the uterus. On the contrary, when many cancerous growths co-exist, they are commonly found in many different organs and tissues. 2. The tissues adjacent to innocent growths are not further altered than in consequence of the pressure and the inflammation which the growth excites; neither is there any evidence that such growths propagate themselves from one part to another. 3. Innocent growths have no natural tendency to ulcerate or slough; those changes happen to them only in the same manner and under the same circumstances as to the natural tissues of the body. Moreover, in ulcerating or sloughing they have no more tendency than the natural tissues in similar conditions have to involve the adjacent parts in their destruction. 4. The tissue of an innocent growth is in general similar to that of some natural and fully-developed tissue of the body.

The class of innocent growths includes most of those to which the name of Sarcoma is now commonly given. Their appearances are so various, that the most practised morbid anatomists frequently meet with examples which they cannot certainly refer to any described variety: yet there are some well-characterised forms, within the descriptions of which may be included a great majority of those which occur in the human body;—and these we shall describe under the names of the Fatty Tumour, or Growth; the Cellular; the Fibrous, or Tendinous; the Cartilaginous; the Osseous; the Fibro-cartilaginous.

The Fatty or Adipose Tumour, to which the name of Lipoma is often given, is the most common of all the tumours occurring in the human body, and, happily, the most innocent, and the most usually capable of remedy by extirpation. Its general seat is in the subcutaneous cellular adipose tissue; but in rare cases it is situated more deeply, and then has a more compact structure and more intimate connection with the surrounding parts. It usually occurs singly; but sometimes twenty or more of various small sizes are seen in the same person. Its elementary tissue is exactly like that of the fat in which it lies, but from which it is separated by a layer of compact cellular tissue, and is generally distinguished by the smallness and distinctness of the lobes composing it. Its blood-vessels are few and of small size, and usually enter it at its base, where it is more closely than elsewhere connected with the adjacent tissues. It is insensible, and commonly grows very slowly, without producing pain, or any other inconvenience than is due to its weight or its pressure on adjacent parts. When left to itself, the adipose tumour may grow to an enormous size. Mr. Copeland removed one weighing 22 lbs.; Sir Astley Cooper, one of 37 lbs. 10 ozs.; and M. Dagorn of Morlaix, one which weighed 46 French pounds. The size of the wound necessarily made in the removal of tumours of such magnitude renders the operation somewhat dangerous; but, except for this circumstance, the extirpation of fatty tumours may usually be undertaken with full confidence of success. If not removed, they are apt, through the distension and thinning of the skin over them, to give rise to ulceration and other more painful affections.

The Cellular Tumour, which derives its name from the similarity of its tissue to that of the common cellular tissue of the body, is a very rare disease. It is composed of a compact substance, infiltrated by a serous or half-gelatinous fluid, and may attain a great size. Mr. Lawrence, in his 'Lectures on Surgery,' has described the best example yet known of it: perhaps also the disease which Mr. Abernethy, in his 'Classification of Tumours,' named Common or Vascular Sarcoma, was of this kind. But, altogether, very little is known of this form of tumour: the great enlargements of the skin of the scrotum, supposed by some to be of the same nature, are widely different from it.

The Fibrous or Tendinous Tumour (the fleshy tubercle of Dr. Baillie) is a very frequent and well-marked growth. Its ordinary, perhaps its only, seat is in the walls or in the neighbourhood of the uterus. Its natural form is almost exactly globular, but when it hangs in a dependent position it generally becomes pyriform. Its tissue has the same microscopic character as that of the natural fibrous and tendinous tissues, and is equally little vascular. Its section presents a very compact and firm semi-transparent basis, intersected by numerous shining, tough, fibrous fasciculi, arranged sometimes in rays proceeding from its centre, but more frequently in irregularly arched and undulating lines. It grows slowly, and at first without pain: but when it has attained some size it usually excites painful and dangerous affections of the uterus; and this is especially the case when the tumour projects into the cavity of that organ. One such tumour may grow alone in the uterus: but more commonly two or more grow together; and sometimes there are from ten to twenty. They may increase so as to form masses nearly a foot in diameter, and in this case they usually end fatally by their pressure on important organs, or by hæmorrhage when they project externally. In advanced stages of their growth, or at any time if they cease to increase in size, they are apt to be calcified; earthy matter being deposited around or within them, so as to form a shell or a coral-like mass of hard substance, which bears some resemblance to ivory, but has none of its microscopic characters.

The progress of the fibrous tumour of the uterus is much modified according to the position which it occupies in the walls of that organ. When it is situated near the peritoneal surface, it grows most rapidly in the direction where there is least resistance, and raising up the few layers of uterine tissue which lie over it, it projects into the cavity of the abdomen. In this way, as the tumour increases in size and stretches the tissue surrounding it, its basis of attachment becomes narrower and forms a mere pedicle; and cases are recorded in which at the last this pedicle has by some accident been broken through, and the tumour has fallen loose into the abdominal cavity. By a similar process, when the tumour begins to grow near the internal surface of the uterus, it gradually projects into the cavity; and in this state, when its basis of attachment has become narrow, it forms the most frequent kind of polypus of the uterus, the fibrous polypus. In this state also the tumour may be removed by cutting through the narrow neck by which it is attached to the uterus with either the knife or the ligature; and cases sometimes happen in which the neck of the polypus becoming very narrow, is broken through by the uterus forcibly contracting, and the whole mass is safely expelled. When however the growth of a fibrous tumour commences in or near the middle substance of the wall of the uterus, neither of these events can happen; and it is in these cases that the tumours attain their greatest dimensions.

The Cartilaginous Tumour is that which has been named chondroid or cartilaginous sarcoma: it is the enchondroma of Müller, and one of the numerous forms of growths which have been heaped together under the term osteo-sarcoma. Its usual and perhaps its only place of growth is within or upon the bones, and it occurs in connection with the bones of the fingers and the last phalanx of the great toe more frequently than in any other part. It grows slowly and usually without any pain, and may continue to increase for thirty or more years. It is most commonly isolated, but sometimes two or more tumours of the same kind occur on one or both hands. The most usual form of the cartilaginous tumour is globular, with an irregular nodulated surface, and a section shows that it is composed of numerous round masses of a greyish-white semi-transparent substance, closely resembling the cartilage composing the skeletons of cartilaginous fishes, and presenting all the microscopic characters of ordinary fœtal cartilage. The component masses, which are especially obvious when the tumour is large, vary in size from two lines to half an inch in diameter, and in different specimens vary much in consistence; they are held together by portions of tough fibrocellular tissue in which blood-vessels run, but are themselves little, if at all, vascular, before the process of ossification has commenced in them.

When a cartilaginous tumour begins to grow within a bone, it gradually destroys by its pressure the surrounding osseous tissue, and may expand the shaft, so that the bone at last forms an osseous shell around it. Müller regards this as the most usual mode of growth, but it is certainly very rare. In the few cases in which the cartilaginous growth commences within a bone, it appears most frequently to make its way through an aperture produced by ulceration in the wall, and then to increase externally to the shaft. But its more common original seat is on the exterior of a bone, either within or external to the periosteum; and it does not become intimately connected with the bone till its base of attachment has become osseous, and has coalesced with the similar tissue of the bone on which it rests. The ossification of a cartilaginous tumour (a change which Müller has entirely overlooked) is a process exactly similar to that of the ossification of the natural skeleton. It may commence in any part of the tumour, and often goes on simultaneously in many insulated points; but it usually begins and makes most rapid progress at the part where the tumour is connected with the bone. As this part ossifies it unites with the wall of the bone, which at the same time loses its compactness and, as it were, breaks out into a cancellous texture, like that into which the tumour is changed; and at the last, the osseous tissue of the tumour and that of the bone on which it is seated become exactly continuous, so that the tumour seems to have been from its origin osseous, and to have grown from, and not into, the interior of the bone. In general the circumference of the tumour remains cartilaginous for some time after the ossification of its base; but at last it also becomes osseous, and is usually covered by a thin layer of compact osseous tissue, which encloses the cancellous tissue into which all the internal part of the tumour has been converted, and becomes continuous with the outer layers of the adjacent healthy part of the bone on which it is seated. After its complete ossification the tumour may still continue to grow; but if it do, it is only as a natural bone grows, by the enlargement of its interior and the formation of concentric layers of compact bone around it: it never presents any external layer of cartilage after its surface has once been completely closed in by bone, nor does its external layer often become much thicker.

The cartilaginous tumour may grow to an enormous size: one in the College of Surgeons, which had almost completely ossified, measures a yard in circumference. It is situated on the upper part of the tibia. But even in the most advanced states they may be removed by the amputation of the part on which they are situated, without fear of their recurring; and this is always an advisable proceeding: for besides the inconvenience produced by their weight and pressure on adjacent parts, large cartilaginous or osseous tumours are apt to produce ulceration and sloughing by their distension of the skin which covers them.

The greater number of those called Osseous Tumours, or osseous exostoses, are only ossified cartilaginous tumours,—examples of what may be called the second stage of the disease last described. It is doubtful indeed whether any tumour possessing the true osseous microscopic structure is formed except through a preceding cartilaginous state. Many other kinds of tumours connected with bones are incorrectly called osseous or osteo-sarcomatous. Such are those connected with medullary or soft cancerous diseases, of which some are only the osseous skeletons upon which the malignant disease was fixed; others are the remains of the original bone expanded and broken out by the growth of the malignant disease in the interstices of its tissue. And again, other hard tumours connected with bones result from what should be called the calcification rather than the ossification of a previous softer growth: for in these the earthy matter is deposited irregularly, and they never acquire the structure of true bone. Most or all of these calcified tumours are of a malignant nature. One of the best characterised forms is that of which Dr. Baillie ('Morbid Anatomy') gives the history, in a case in which, after Mr. Hunter had amputated the patient's leg, calcareous masses, similar to that which had formed within and around the femur, were developed within the lungs and upon the ribs.

The history of the Fibro-cartilaginous Tumour is as yet more imperfect than that of any of the preceding, except the cellular. It is most frequently, or always, connected with the bones, and is most commonly met with upon the jaws, from which it may be removed without fear of recurrence. It has usually a round or oval form, and its surface is less deeply nodulated than that of the cartilaginous tumour. It may attain a great size, and commonly leads to sloughing and ulceration of the tissues over it, if not timely removed. It is composed of a very firm, compact, pale, whitish or yellowish, albuminous tissue, in which small spicula of bone are often scattered, but which does not become truly or entirely osseous. It may grow within a bone, but more usually it commences on its exterior: in the former case it generally expands the shaft or body of the bone into a shell around it; in the latter the surface of the bone is broken up, and seems to coalesce with the tissue of the tumour.

In different examples the fibro-cartilaginous tumour presents various degrees of consistence, and not a few apparent diversities of internal structure. In some examples its substance is homogeneous, in others obscurely fibrous; and from these last, which are the most frequent, it derives its name, which is intended to express its general aspect rather than its minute structure, for the firm tissue of which it is chiefly composed has not the microscopic or chemical characters of cartilage. In other examples again the fibrous structure rather predominates over that which resembles cartilage; and in others numerous cells, containing a glairy or a serous fluid, are scattered through the interior of the mass. From the existence of such diversities, it is not unlikely that more than one kind of tumour is included in this name; but the gradations, from the examples in which the tissue is most nearly homogeneous to those in which it is most fibrous, or contains most cells, are so numerous and gradual, that it seems more probable that they are all of one kind, modified by accidental circumstances, or examined in different stages of their development.

The treatment of the tumours whose natural history has been described may be summed up in a few words. There is no remedy for them but their removal: not one of the medicines proposed for exciting their absorption is worthy of a trial. Of the means of removing them (when removal is possible), none is so safe, so expeditious, or productive of so little pain or inconvenience, as the knife; and whenever it can be employed, the sooner it is used the better, for, in general, delay can only increase the severity of the operation. For the operation itself, the only general rule is, that the whole of the diseased mass must be removed; any portion which is left will most probably become the nucleus of a similar growth. The particular proceedings must be varied according to the size, locality, and other circumstances of the tumour.

TU'MULUS (or Barrow), a Latin word, signifying a 'little hill.' Tumuli, or artificial mounds of earth, of various sizes and forms, are found in many parts of the globe, and are commonly supposed to be tombs, or sepulchral memorials of persons of distinction, or of warriors slain in battle.

That some of these artificial mounds were originally raised for, or at least appropriated to, other objects than that of sepulture is probable; but of this we have no satisfactory evidence. We limit our present remarks to the consideration of Tumuli as Sepulchral Monuments.

In the book of Joshua mention is made of heaps of stones raised over dead persons, which in course of time would assume nearly the appearance of barrows at the present day. This practice seems however to have been done in the case of enemies only, and was doubtless intended as a mark of abhorrence. The earliest account of tumuli as honorary memorials of the dead is in the poems of Homer. His descriptions of the funerals of Patroclus and of Hector, in the 'Iliad,' differ in very trifling particulars; but in each the same mode of inhumation is commemorated. The ceremony of burning the body took place during the night, and at the dawn the embers were quenched with wine. The ashes of the deceased were enclosed in an urn, placed near the centre of the space occupied by the pyre, which was surrounded by an artificial substructure, or a foundation, and the loose earth was heaped above it. The word used by Homer to denote the throwing up of such loose earth (χεύω) is strikingly picturesque; and its propriety will be readily acknowledged by persons who have seen the outline of many of those primitive sepulchres, which has evidently resulted from the loose earth being allowed to settle at the angle which it would form when thrown up.

This peculiarity has not been clearly expressed in the version of Pope:—

> 'That done, they bid the sepulchre aspire,
> And cast the deep foundations round the pyre;
> High in the midst they heap the swelling bed,
> Of rising earth, memorial of the dead.'—*Iliad*, xxiii. 255.

In later ages we find accounts of immense sepulchral tumuli. Such was that of Alyattes, the father of Crœsus, which is described by Herodotus and by Strabo. [ALYATTES.] A sepulchral mound which still exists near the site of Acanthus was raised by the army of Xerxes, in memory of a noble Persian who had superintended the construction of the canal which was cut across the isthmus of Athos. [ATHOS.]

Tacitus, from whom we derive the first satisfactory account of the Germans, observes that their funerals were distinguished by no empty pomp. 'The bodies of illustrious men were consumed with a particular kind of wood; but the funeral pile was neither strewed with costly garments nor enriched with fragrant spices. The arms of the deceased were committed to the flames, and sometimes even his horse. A mound of earth was then raised to his memory, as a better sepulchre than those elaborate structures which, while they indicate the weakness of human vanity, are at best but a burthen to the dead.' (*Germania*, xxvii.)

Whether the body was preserved entire or committed to the flames, the custom of depositing the remains of dead bodies under a mound of earth has been observed in nearly every part of the world; by the antient Scythians on the banks of the Borysthenes (Herod., iv. 71), and by the aborigines of North America on the banks of the Ohio.

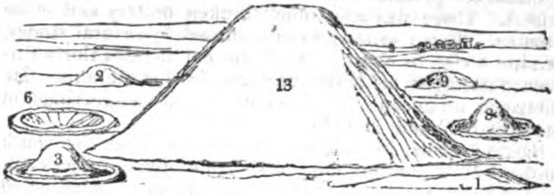
Of the sepulchres of the Scythian nations many are found in the Kuban. Rennell (*Geography of Herodotus*) describes them as perfect tumuli, sometimes of great height, on a base formed by a square wall of large stones. In some cases the earth is excavated to a considerable depth; in others it merely covers the body. The deposits, with the remains of the dead, are weapons and implements of war, domestic utensils, and idols.

Some of the tumuli scattered over various parts of Germany have been examined. They are distributed by the antiquaries of that country into four classes: 1. Tumuli without bodies, or urns. 2. Tumuli with bodies, but without urns. 3. Tumuli without bodies, but with urns baked. 4. Tumuli with both bodies and urns. Of the last class several were opened in the neighbourhood of Sinzheim, and skeletons were found in them, with rings of brass and iron about the arms, feet, and fingers, ear-rings, and chain or other ornament surrounding the neck. (Meidinger, *Die Deutschen Volkstämme geographisch und geschichtlich beläüchtet*, p. 208, &c.)

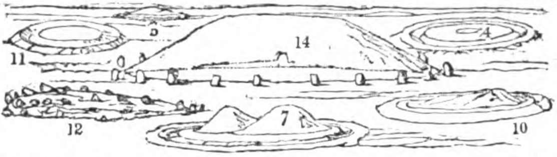
The first careful investigations into the tumuli of this country were made by Dr. Stukeley in the neighbourhood of Stonehenge above a century ago. (Stukeley's *Account of Stonehenge*, fol. 1740.) The attention of the public was a second time drawn to the subject by Douglas, in his 'Nænia Britannica,' published in 1793: his researches were confined to the southern coast of England, and chiefly in the county of Kent.

In the agricultural and densely-peopled districts, barrows have mostly disappeared; but in the counties of Wilts and Dorset, and the adjoining parts of Hampshire, they are scattered over the open downs, and crown the more elevated ranges of hills which are yet untouched by the plough. Fortunately, a gentleman who had perseverance to prosecute the investigations begun by Stukeley and Douglas, and with ample means to carry them into effect, was found in the late Sir Richard Colt Hoare, whose attention was first directed to the subject, and who was materially assisted in his researches and literary labours by Mr. Cunnington, a tradesman and self-taught antiquary of Wiltshire. In no part of Europe have tumuli been so completely explored as in Wiltshire, and their contents have been minutely and carefully explained in Sir Richard C. Hoare's 'Antient Wiltshire,' 2 vols. fol., 1810, 1821. Considering tumuli according to their shape, we cannot adopt a better classification in general than that of the work referred to, which is indeed partly grounded on local names and distinctions.

'We must not,' he observes, 'consider every barrow as a mere tumulus, or mound, loosely and fortuitously thrown up; but must rather view them as works of evident design, and executed with the greatest symmetry and precision. The long barrow (see No. 1, annexed illustration), from its singular form and large size, claims the first notice. These barrows differ considerably in form as well as magnitude. Some resemble the half of an egg cut down the middle; some are almost triangular; some form a ridge of equal breadth throughout; but the greater number are wider at one end than the other, and that end is usually turned towards the east. They are commonly placed on elevated situations, and stand singly. They differ materially from circular barrows in their contents; for brass weapons, or trinkets, are never found in them. With few exceptions, bodies appear to have been laid on the floor of the barrow, at the broadest end, in an irregular manner; and near one or two cists, cut in the native chalk, and covered with a pile of stones or flints.



The bowl barrow (No. 2) is the shape most usually found. It abounds on the Mendip Hills, in Somersetshire, and is sometimes surrounded with a shallow ditch. Dorsetshire also contains many barrows of this class.



The bell barrow (No. 3), from the symmetry of its shape, is probably an improvement on the bowl barrow. It occurs in the vicinity of Stonehenge.

Of the Druid barrow, as it was miscalled by Stukeley, Sir Richard C. Hoare distinguished three varieties. (Nos. 4, 10, and 11.) There seems some reason to assign this class as designed for the interment of females. The outward vallum, with the ditch within, is moulded with great care. In the area are sometimes one, two, or three small mounds, which in most cases have been found to contain small articles, such as cups, and lance-heads, also amber, jet, and glass beads.

Two other varieties of the Druid barrow have been casually observed. One is a low mound, enclosed within a vallum, and occupying almost the whole area. (No. 5.) In the other the area is perfectly flat, and rises in a curved line from the vallum. (No. 6.)

The twin barrow (No. 7) consists of two conical mounds within a foss.

The broad barrow (No. 9) resembles the bowl barrow, but is wider and flatter at top.

Two other forms are mentioned, the pond barrow (No. 6) and the cone barrow (No. 8). The first is certainly not sepulchral, and perhaps the antiquity of this kind may be questioned. Of the cone barrow only a single example has been noticed—near Everleigh, on Salisbury Plain.

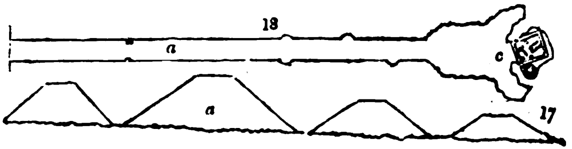
Another kind appears to have escaped the notice of Sir Richard C. Hoare. These barrows are so slightly elevated that they can scarcely be discovered, except in the morning and evening, when the shadows are broad and marked. Their contents show them to belong to an early period.

No. 12, a tumulus called Milbarrow, near Avebury, Wiltshire, set round with stones, is represented and described by Dr. Stukeley, in his work on Avebury, fol., 1743.

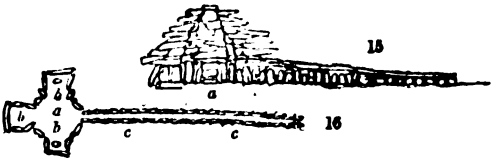
A remarkable barrow, which has acquired much notoriety from the popular writings of Sir Walter Scott, being particularly noticed in his novel of 'Kenilworth,' and known by the name of Wayland Smith, is found on a lofty ridge near White Horse Hill, in the county of Berks, England. It is one 'of those long barrows which we meet with occasionally, having a kist-vaen of stones within it to protect the place of interment.' (*Antient Wiltshire*, vol. ii., p. 47.)

In the county of Dorset, about five miles west of Blandford, on the open downs, is a tumulus called Deverel Barrow, which was explored in 1825 by Mr. W. A. Miles, and found to contain twenty-one unbaked urns, fragments of which are preserved in the museum of the Institution at Bristol. There was also much broken pottery and other remains. These articles were enclosed by several stones, forming a cist, or chest. Mr. Miles enumerates thirty different interments as being traceable in this tumulus. He published an account of its contents, with engravings, in an octavo volume, in 1826.

Bartlow Hills, in the county of Essex, on the south border of Cambridgeshire, is a name given to four tumuli, arranged in a row, and varying in size, as indicated in the diagram below (No. 17). The largest of these, *a*, measuring 142 feet in diameter by 44 feet in height, was explored in 1835 by Mr. J. G. Rokewode and other gentlemen, who excavated a passage or gallery on the surface of the natural earth, from the extreme base to near the centre of the barrow. This line or gallery is marked (No. 18) *a*, extending 56 feet, where the workmen were ordered to extend the open space on each side; and at the distance of 13 feet they came to a square enclosure, or chest (*c*), which was found to contain various antique relics of genuine Roman or of Brito-Roman manufacture. These were glass urns or bottles, a bronze lamp and cup, a patera, a præfericulum (a long or tall vase, with a particular handle), glass vessels, a folding chair, bronze strigils, an enamelled vase, &c. The last and the bronze præfericulum are elegant and extraordinary vessels, and the only examples of the kind ever found in any of the tumuli of Great Britain. A particular account of these objects is given in the 'Archæologia,' vol. xxvii.



At a place called the New Grange, near Drogheda, Ireland, there was a remarkable tumulus, which was explored in 1770 by governor Pownall, who wrote an account of the barrow and of other objects in the vicinity, for the Society of Antiquaries of London, and published the same in vol. ii. of the 'Archæologia.' He states that the mound consists mostly of large pebble stones, which must have been conveyed about 12 or 14 miles; and by calculation the whole weighed at least 189,000 lbs. The height is 70 feet, and the diameter about 400 feet. Surrounding its base was a series of rude stones, placed in a circular form, on their ends, as indicated (No. 14). A gallery formed of upright stones, *c c*, with others placed on their tops, extended from the outer edge to near the centre of the tumulus, where there was an area surrounded by other stones, and covered by a dome or cupola, *a*. Branching from this area were three square recesses, *b*, *b*, *b*. The accompanying diagrams show a plan and section of the gallery.



Silbury Hill, near Marlborough, Wiltshire, is one of the largest barrows in the world. [Avebury.] See the cut in a preceding column, No. 13.

Sir Richard C. Hoare considers the deposition of the body entire, and its reduction to ashes by fire, to have been practised at the same time. There are however varieties of both. In the first and most antient interments the body is enclosed in a cist, with the legs and thighs drawn up, and the head generally turned towards the north. The second is of much later date. The body is deposited at full length; but the head is placed in no particular position, and arms and various instruments of iron accompany the skeleton. In the same manner two modes of depositing the remains, after they were burnt, have been practised. In the more antient, the fragments of the burnt bones were collected and laid on the floor of the barrow, or in a cist excavated in the native soil. In the second, which is clearly the later, the bones and ashes were inclosed in a funeral urn, which was placed in a cist, usually with the mouth downward. In these cases portions of the cloth which enveloped the urn have occasionally been discovered, as well as small brass pins, by which the cloth was apparently fastened.

Of Urns many varieties have been found in exploring the tumuli. The first or largest class was properly the sepulchral urn, and is always found to contain bones. The second is different both in shape and design: it contained neither ashes, bones, nor trinkets; and as the custom prevailed of depositing articles of food with the dead, these have received the name of drinking-cups, from a supposition that they were intended to hold fluids. Such vessels are frequently found with skeletons, and are placed either at their head or feet. They are always ornamented with patterns, and would contain about a quart. The third are smaller still, and more fantastic in shape. They are too diminutive to have been receptacles for ashes. They were probably intended for perfumes, and have accordingly been named incense-cups.

To the remarks of Sir Richard C. Hoare we may add, that the remains found in the Wiltshire barrows indicate three distinct stages or eras of society. The first was before the introduction of metals, when arms and implements consisted of spear-heads of flint, and arrow-heads of flint or bone; the second, when these articles were of brass; and the latest, when iron instruments, arms, and utensils accompany the deposit. Of the sepulchral urn also there are two varieties, indicating different periods of mechanical art. In the first the urn is fashioned by hand, without ornaments, or with those of the rudest kind, and dried by the heat of the sun. In the second, it was evidently wrought on the lathe, ornamented by the application of some instrument with zigzags and other patterns, and finished and baked with different degrees of skill and attention. Possibly the first of these may belong to the earliest known inhabitants of Britain; and the others may perhaps be assigned to the latest Belgic colonists. It is also likely that in the West of England the different modes of interment in barrows had ceased before the establishment of the Romans; at least no coins nor other Roman objects, which might have been introduced into England during the Roman occupation, have ever been found in the course of researches which have scarcely left a single barrow in south Wiltshire unexplored. [Avebury; Pyramids; Cairn; Cholula.]

TUN. [Ton.]

TUNBRIDGE. [Kent.]

TUNBRIDGE WELLS. [Kent.]

TUNE, in Music, a short air, or melody, with both or either of which terms it is synonymous. A vocal *Tune* is a song, a ballad, in England; an *ariette*, a *vaudeville*, in France; a *gesang* in Germany; a *canzonetta*, an *arietta*, in Italy; a *seguidilla* in Spain; &c. In instrumental music a *Tune* is variously denominated,—dance, hornpipe, jig, *gigue*, *giga*; waltz, *valse*, *waltzer*, *fandango*, &c., according to the country in which it had its origin or is naturalized. [Air; Melody.]

TUNGSTEN, a metal first obtained in a perfect state by M. M. d'Elhuyart, in 1781. Its name is derived from the Swedish words *tung sten*, 'heavy stone,' on account of the density of its ores.

The properties of tungsten are—that it has a greyish-white colour, and considerable lustre. It is brittle, and nearly as hard as steel: its specific gravity is 17·4, and with the exception of platina, gold, and iridium, is therefore the heaviest known metal. It requires a very high temperature for fusion, greater even than that necessary to melt manganese. It is not altered by exposure to the air. When heated to redness in the open air it takes fire, combines with oxygen, and is converted into tungstic acid, and nitric acid produces the same effect upon it. Tungsten may also be obtained by passing hydrogen gas over the heated oxide of tungsten, or by immersing zinc in a solution of tungstate of ammonia.

We shall now mention the principal minerals which contain tungsten, and in these it exists either as oxide of tungsten or as tungstic acid.

Tungstic Acid. Scheelic Acid.—Occurs pulverulent or in small friable masses, but with some appearance of crystallization. Fracture conchoidal. Inodorous, tasteless. Colour varies from orange or chrome-yellow to yellowish-grey. Lustre adamantine. Translucent. Specific gravity 6·0.

It is insoluble in acids, but soluble in caustic potash and also in solution of ammonia when heated, and is precipitated from them by acids in the state of a white powder. Before the blowpipe it gives a blue glass with microcosmic salt. It has been found on the surface of wolfram and sometimes on that of tungstate of lime, at Huttington in Connecticut, and Zinwald in Bohemia.

It is stated to consist of—

Oxygen . . .	20·23
Tungsten . .	79·77
	——100

Tungstate of Lime. Scheelate of Lime.—Occurs massive and crystallized. Primary form a square prism. Cleaves parallel to the faces of some modifications. Fracture uneven, imperfectly conchoidal. Hardness—scratches fluor-spar, and is scratched by apatit. Colour—white, yellowish-grey, yellowish-brown, and sometimes reddish-brown. Streak white. Lustre vitreous. Translucent; transparent. Specific gravity 6·076.

By the blowpipe difficultly fusible into a transparent glass. Slowly acted on by nitric acid, which leaves a residue of tungstic acid.

This substance occurs in Bohemia and Sweden, and in the English counties of Cornwall and Cumberland, and also in America.

Analysis by Berzelius:—

Tungstate acid .	80·417
Lime . . .	19·400
	——99·817

It sometimes contains small portions of silica, and of the oxides of iron and manganese.

Tungstate of Iron and Manganese. Wolfram. Scheelate of Iron and Manganese.—Occurs crystallized, massive, and pseudomorphous. Primary form an oblique rhombic prism. Cleavage parallel to the terminal plane, and to both its diagonals. Fracture uneven. Hardness 5·0 to 5·5. Yields readily to the file. Colour blackish and brownish-black. Streak dark-brown, or slightly reddish-brown. Lustre semi-metallic. Opaque. Specific gravity 7·155.

Before the blowpipe wolfram decrepitates, and at a very high temperature melts into a globule covered with crystals of a metallic lustre. With phosphate of soda it melts into a transparent bead of a deep red colour.

Its constituents, according to the authorities named, are—

	Berzelius.	Vauquelin.	Richardson.
Tungstic acid . .	74·666	73·511	73·60
Protoxide of iron .	17·594	20·745	11·20
Protoxide of manganese	5·640	5·744	15·75
Silica	2·100	..	..
	100·	100·	100·55

This mineral very frequently accompanies tin-ore in the English county of Cornwall, in Bohemia, and in Saxony. It is also found in various other countries, as America, Siberia, Scotland, &c.

Tungstate of Lead.—[Lead,—*Ores of.*]

We shall now describe some of the compounds which tungsten forms with other elementary bodies.

Oxygen and Tungsten.—We have described below a natural compound of these substances under the name of tungstic acid; but a mere oxide, not possessing acid properties, may be obtained by fusing finely powdered wolfram, or tungstate of iron, with twice its weight of carbonate of potash, and dissolving in hot water the tungstate of potash formed, adding hydrochlorate of ammonia to the solution, evaporating the mixture to dryness and heating it to redness. The residue, after washing in boiling water, and digesting in a dilute solution of potash, is oxide or binoxide of tungsten. Its properties are, that it is black: it is insoluble in water, alkalis, and acids by direct action, but when formed in a different mode from that now described it may be combined with soda. When it is heated to redness it suddenly ignites and is converted into tungstic acid, by absorbing oxygen during combustion. This oxide may also be formed by passing hydrogen gas over heated tungstic acid; its colour, when thus obtained, is brown. It consists of—

Two equivalents of oxygen .	16
One equivalent of tungsten .	100
Equivalent . ,	——116

Tungstic Acid.—We have already stated that this may be obtained by decomposing the native tungstate of lime, by heating the oxide in the air, or, which is the best method, by heating tungstate of ammonia to redness so as to expel the ammonia. The properties of this substance are, that it is pulverulent, of a yellow colour, insoluble in water, but readily dissolved by the caustic alkalis, forming with them salts called tungstates. When recently precipitated from the alkalis by acids, it forms compounds with them which are soluble in water.

It is composed of—

Three equivalents of oxygen	24
One equivalent of tungsten	100
Equivalent .	——124

When this acid is heated to about 600° and a current of hydrogen is passed over it, a blue substance is obtained, and it is also procured by immersing zinc in a mixture of hydrochloric and tungstic acids. This Berzelius considers as a tungstate of tungsten, probably composed of—

Two and a half equivalents of oxygen	20
One equivalent of tungsten . .	100
Equivalent . .	——120

Chlorine and Tungsten form two compounds: when the metal is heated in the gas, combustion occurs and the bichloride is formed. It has sometimes the form of delicate red needles, but more commonly that of a deep red fused mass resembling cinnabar in fracture. When heated it emits a red vapour, and is by water converted into hydrochloric acid and oxide of tungsten.

It is composed of—

Two equivalents of chlorine .	72
One equivalent of tungsten .	100
Equivalent . .	——172

Although there appears to exist another chloride of this metal, chemists are scarcely agreed either as to properties or composition.

Sulphur and Tungsten form a sulphuret, or perhaps two compounds; they are however but imperfectly known.

The tungstates of ammonia, potash, and soda, are all soluble and crystallizable compounds; while those of lime, barytes, and strontia are insoluble.

TUNGUSES. [Siberia, vol. xxi., p. 469.]

TUNICATA, a group of animals which, although very low in the creation, has, as Mr. W. S. MacLeay observes, in consequence of the investigations of Cuvier, and particularly those of Savigny, attracted a considerable portion of attention.

Mr. MacLeay remarks that, although it is a proposition now almost undisputed that zoology cannot be satisfactorily studied without comparative anatomy being taken for its basis, it may not be amiss to cite as examples of the truth of this assertion the singular discoveries of Savigny on the compound *Tunicata*. The wonderful facts which that distinguished naturalist has recorded could never, Mr. MacLeay observes, have been discovered by him, had he confined his attention to external appearances. 'Disdaining to rest contented with the manufacture of names, he employed himself in the investigation and generalization of physiological facts; and his discovery of compound *Tunicata*, 'I conceive,' says Mr. MacLeay, 'to be such as may deservedly be placed at the side of that of the metamorphosis of Batrachian reptiles, or any other important physiological fact whatever.'

Mr. MacLeay, after enforcing the necessity of dissection, as stated in the article Boltenia, proceeds to quote Cuvier, who says, 'The external form of the *Ascidiæ* being subject to many variations, their surface offering no great differences, their colour not remaining after death, and differing probably during life according to age and locality, it is surely difficult to distinguish them without having recourse to their interior;' and so well aware, observes Mr. Mac Leay, was Aristotle of this truth, that he has given us an anatomical account of such species of *Ascidiæ* as he was acquainted with, so detailed and so accurate as to puzzle his commentators, and to lead some of them to believe that his description was in fault rather than their own knowledge of natural history.

The *Tunicata* had always been interesting to Mr. Mac Leay as an osculant group connecting the polype *Acrita* and acephalous *Mollusca;* and he remarks that this situation, assigned to them in the *Horæ Entomologicæ*, cannot now for a moment be doubted. Their relation to the testaceous mollusca has likewise been pointed out, he observes, by Aristotle, Baster, Linnæus, Pallas, Cuvier, and Savigny. Their relation to the Polypes has likewise been shown by Savigny, when he demonstrated that the *Alcyonium ficus* of Linnæus (*Alcyonium pulmonarium* of Solander and Ellis) is nothing else than an aggregation of minute *Ascidiæ* combined in a common envelope. Indeed, continues Mr. MacLeay, it is rather curious to remark that the affinity of these animals to *Mollusca*, although so early noticed, is less striking to modern naturalists than that affinity which they bear to polypes, and which was only discovered the other day. Mr. MacLeay however qualifies this observation by referring to the *Dict. des Sciences Natur.*, art. 'Mollusque,' p. 363, where M. de Blainville compares them particularly with the genus *Mya*.

Mr. MacLeay then refers to Savigny's distinguishing character of the *Tunicata*, namely, their having a soft test or covering, consisting of an organized envelope, provided with two orifices, the one branchial, the other anal; and he remarks that if this character be correct, as there is every reason to believe it to be, the imperfectly known genus *Mammaria* will, if truly described by Müller, not belong to this group, although it has been placed there by Lamarck. There is great obscurity however, he observes, hanging over this genus as well as BIPAPILLARIA, which, upon the authority of some manuscript notes of Péron, is said to have rigid tentacula. By one of the orifices above mentioned the *Ascidia* imbibes the sea-water, and introduces it into the branchial cavity; but Mr. MacLeay refers to Aristotle for a general account of the structure of that group of *Tunicata* which comprises Aristotle's *Tethya*, or the *Ascidians* of Savigny.

Aristotle, then (*Hist. Anim.*), observes, under the head of Testaceous Animals (τὰ ὀστρακόδερμα), that 'there are some, such as those called Τήθυα, which are so entirely surrounded by their test or envelope as to have no part of their flesh exposed.' So far, as Mr. MacLeay remarks, this accurately drawn character may apply to the whole of the *Tunicata*. But Aristotle afterwards proceeds to a more definite description of the *Tethya*:—'But of all these animals (the ostracoderms) those which are called *Tethya* have the most remarkable nature; for with them alone is the body entirely concealed in the test. This test or envelope (τὸ ὄστρακον) is between the texture of leather and shell, and may be consequently cut like a piece of tough hide. The animal adheres to the rocks by its test, and has two passages or orifices (πόρους), distant from each other, and so small as not to be easily visible. By means of these it imbibes and discharges the water. On opening one of these animals, the inside presents, in the first place, a membrane, composed as it were of nervures (ὑμένα νευρώδη), and communicating with a fleshy intestine (τὸ σαρκῶδες); so that the intestine of the *Tethyon* appears contained in the reticulated membrane. Although, indeed, the flesh is alike in all testaceous animals, this intestine resembles in form that of none of them. It is suspended at two places, viz., to the above-mentioned membrane, and to the muscle which proceeds from the side (literally, 'to the skin from the side'); and wherever it adheres to either of these it is narrowest. At each point of suspension this intestine tends towards those orifices which lead to the outside of the test, and by which it receives and discharges the food and water; so that if one of these apertures be the animal's mouth, the other must be its anus. One of these orificial processes (the branchial orifice) is thicker than the other. Within the cavity also of one or other of them there is a certain small cohering substance which divides it.'

Mr. MacLeay, who thus translates a passage presenting almost insuperable difficulties to any but a zoological scholar, observes, that 'the membrane, composed as it were of nervures,' is a good description of the beautifully reticulated membrane which forms the branchiæ of the *Tethya*. Aristotle, he adds, appears however by some mistake to have considered the branchial pouch as surrounding the intestine; and he remarks that he suspects that the small cohering or continuous substance which Aristotle alludes to immediately after the mention of that part which Mr. MacLeay considers to be the branchial orifice, is the valvule of the anal orifice.

Mr. MacLeay then proceeds to show the connection of the *Acrita* with the *Mollusca* by means of the *Tunicata*, as stated in the article BOLTENIA; and he says that this osculant group may be divided as follows:—

TUNICATA.

	Families.	*Animals.*	*Generic Types*
Aberrant Group? 1. Tethya, Or such *Tunicata* as have their mantle adhering to the envelope or test only at their orifices;—their branchiæ regular, constituting the sides of the respiratory cavity; and their branchial orifice surrounded by a membranaceous ring, which, in general, is supplied with tentacula, as in Polypes.	1. Ascididæ. *Tethyes simples*, Sav.	Simple and fixed, having their orifices externally irregular.	Ascidia.
	2. Botryllidæ. *Teth. composées*, Sav.	Compound and fixed, having their orifices externally regular	Polyclinum.
	3. Lucidæ. *Lucies*, Sav.	Compound and floating, having their branchial cavity open at the two extremities	Pyrosoma.
Normal Group? 2. Thalidæ, Or such *Tunicata* as have their mantle adhering everywhere to the envelope; their branchiæ irregular, consisting of two foliated processes attached to the sides of the thorax; and their branchial orifice merely provided with a valvule.	4. Biphoridæ.	Aggregated in their young state and floating............	Salpa.
	5.	....	....

Mr. MacLeay observes that De Blainville considers that *Pyura Molinæ* makes the passage from the simple to the compound *Tethya*; that is, from the *Ascididæ* to the *Botryllidæ*. Savigny shows, Mr. MacLeay remarks, the affinity of these to *Pyrosoma*, and of *Pyrosoma* to *Salpa*, or (as it is sometimes called, although the name is preoccupied in botany) *Thalia*. De Blainville indeed, he adds, goes so far as to call the *Lucidæ* '*Salpiens agregées*;' and although Mr. MacLeay thinks that no great stress ought to be laid on this arrangement, from M. de Blainville's obvious wish to obliterate the inimitable labours of Savigny, it is clear, he admits that the affinity between *Pyrosoma* and *Salpa* is strong. A fifth group of the *Tunicata* is, he observes, wanting to connect the *Biphoridæ* and the *Ascididæ*; and he says that he has no doubt that such animals will soon occur to reward the industry of those who collect *Mollusca* and *Acrita*.

After remarking that the *Tethya* of Aristotle, or, as Pliny calls them, the *Tetheæ*, are in general incapable of locomotion, Mr. MacLeay proceeds to explain the structure of BOLTENIA, CYSTINGIA, and CYNTHIA, all of which, he says, belong to the natural family *Ascididæ*, and seem to have been dredged from the bottom of the Northern Seas, where they lay fixed, either to submarine rocks, sand, or sea-weed, or to other animals sedentary like themselves.

For the general definition of *Cynthia*, see the article. The following anatomical character and synopsis of the subgenera are given by Mr. MacLeay:—

Anatomical Character.—*Branchial pouch* divided into longitudinal folds, surmounted by a circle of compound or simple tentacula; the meshes of the respiratory apparatus destitute of papillæ. *Abdomen* lateral.

Mr. MacLeay observes that M. de Blainville seems not to have sufficiently studied these animals; for, after giving an erroneous character to the genus *Ascidia*, and confounding it with the genus *Phallusia* and *Clavellina*, he ends with acknowledging that with respect to the species 'leur distinction est assez difficile.' (Art. *Mollusque*, in *Dict. des Sciences Naturelles*.) Mr. MacLeay adds that Dr. Fleming has, on the other hand, given a very good view of this natural group in the article '*Mollusca*' of the supplement to the *Encyclopædia Britannica*.

Synopsis of the Subgenera.

Normal Group. 1. *Branchial pouch* with more than eight folds. *Tentacula* compound. *Liver* distinct.	1. Cynthia......	*Reticulation* of the branchial pouch continuous.
	2. Cæsira, Sav...	*Reticulation* of the branchial pouch interrupted.
Aberrant Group. 2. *Branchial pouch* with only eight folds. *Tentacula* simple. *Liver* none.	3. Styela, Sav. ..	*Ovaries* several, one at least on each side of the body
	4. Pandocia, Sav.	*Ovary* unique, *i.e.* only the right one, which is comprised in the intestinal loop.
	5. Dendrodoa, MacLeay	*Ovary* unique, *i.e.* only the left one, which is ramose or branched, and situated between the branchial pouch and mantle.

'The *Tunicata*,' says the distinguished zoologist, to whom the public are indebted for this lucid and philosophical analysis, 'agree with their contiguous group the *Mollusca* in the remarkable variation that exists in their system of generation. Like every other solitary character that can possibly be adopted for the ground-work of a Zoological system, the mode of generation ought to rise in importance only in inverse proportion to its degree of variation. In a group of animals, for instance, where it varies according to the species, it is evidently of less importance, as affording natural characters, than among those groups where it remains less subject to variation. When the naturalist happens to consider that he ought always to obtain his group before he attempts to find its character, he is sure to perceive this truth; and it is on this very principle that Savigny, with his usual discrimination, has proceeded in the above natural arrangement of the genus *Ascidia*, which I have done little more than borrow from him. To this naturalist, whose works I cannot too often recommend to the careful attention of zoologists as models for imitation and true examples of the method in which natural history ought to be studied, I would willingly have dedicated the following genus' [DENDRODOA], 'but his name happens to have been employed in other branches of the science.' (*Linn. Trans.*, vol. xiv.)

We earnestly desire to impress the principle inculcated in the last paragraph upon the mind of the zoological student.

Mr. Broderip and Mr. G. B. Sowerby have described a curious form belonging to this natural group.

Group, *Tunicata*.—Family, * * * * ?—Genus, *Chelyosoma*.

Generic Character.—*Body* sessile, fixed, involved in a coriaceous test or envelope dividedly laminate above. *Orifices* conical, each closed with six trigonal valvules.

Example, *Chelyosoma MacLeayanum*..

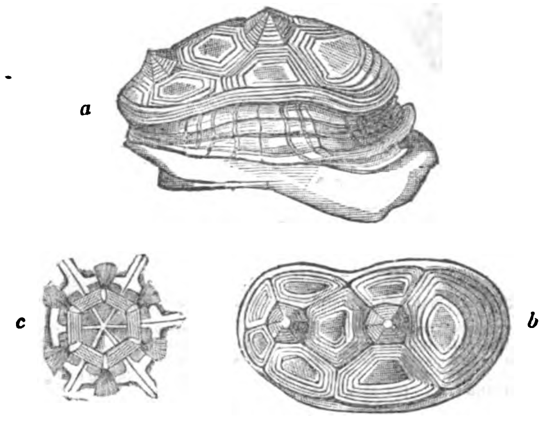
Description.—Elongate-ovate, affixed at the base, flat above, octopartite, the laminæ striated; orifices prominent.

Locality.—The Arctic seas, adhering to stones.

This animal comes nearest to the *Tethya* above noticed, but there are no traces of tentacula surrounding the branchial orifice. It differs from the *Thalida* inasmuch as the mantle seems to adhere to the orifices only, and, instead of a simple valvule, each orifice of *Chelyosoma* is furnished with a complicated one. From the *Ascididæ* it differs inasmuch as both its orifices are surrounded by six valves, instead of being quadrifid.

There were four specimens, one of which was sacrificed to the inquiry, the authors being fully aware of the value of internal investigation, more especially in animals of this class; decomposition however was so far advanced that the ovaries and other viscera were nearly reduced to a shapeless pulp, and they could only trace the following parts of the interior structure. But, before the result of their observation is laid before the reader, it may be well to state that the decomposition which prevented anything like an accurate demonstration of the ovaries and other viscera was, apparently, occasioned by the spirit in which the specimen had been preserved not having sufficiently penetrated to the internal parts. This is mentioned in order to draw the attention of collectors to the necessity of puncturing the external integuments, muscular coats, &c. of such animals as are plunged entire into spirit, in order that it may reach and preserve the viscera.

The mantle appeared to adhere only to the orifices, each of which consists of six triangular valvules. Each valvule is furnished with a set of muscular fibres, adhering at one end to the inner surface of the tunic, and at the other extremity to a small process on the valvule. These muscles appear to be the agents for opening and shutting the valvules. Besides this set of muscular fibres and within them there is another set, which passes laterally from one papilla to another, forming a sphincter, the base of which is hexagonal. (Fig., *c*.) There are other strong subcutaneous muscular fibres, passing from the edge of the coriaceous plates which form the upper surface. These appear to be intended to give the animal the power of dilatation and contraction. Externally the animal is of an oblong cup-shape, adhering by coriaceous processes from the lower part of the cup. The upper surface, which is flat, consists of eight coriaceous, somewhat horny, angular plates. One of these is placed between the two orifices, and, in four specimens which were examined, this was of an hexagonal shape, the sides coming in contact with the orificial valvules, being lunated. The plates are so disposed that the branchial orifice is surrounded by three plates, and the anal orifice by four, besides that which is intermediate and abuts upon both. The three plates near the branchial orifice are much larger than the four which are near the anal orifice. Each of the plates is marked with three or four elevated striæ, parallel to the sides of the plate, and near to them, leaving an area in the centre, and bearing a striking resemblance to a land-tortoise's shell. The orifices are very small, and are surrounded by six triangular valvules, each transversely striated, and, when shut, rising from the surrounding surface in the form of a cone. The lower or cup-like part is formed of a coriaceous substance, with slight traces of separation into plates, but without internal muscular fibre. In one specimen only there were two irregular somewhat horny plates at the external base of the cup, but not so strongly marked as the upper plates. These lower plates were not to be observed in a lower specimen which was removed for the purpose of examination from the stone to which it was fixed. (*Zool. Journ.*, vol. v.)

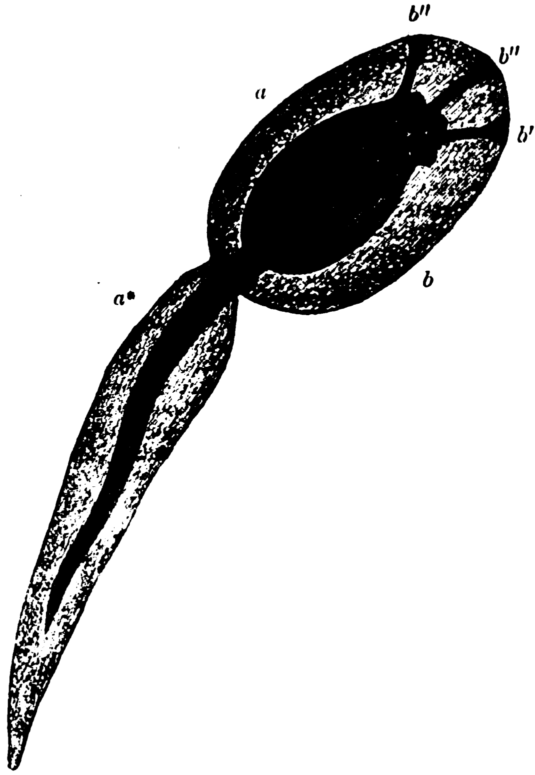


Chelyosoma MacLeayanum.

a, side view; *b*, seen from above; *c*, interior of valvule.

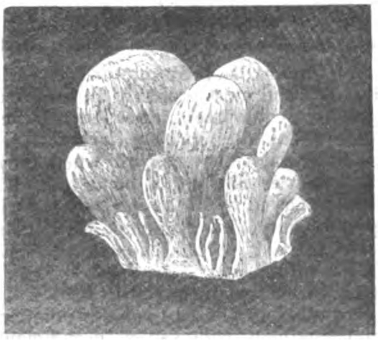
[BOTRYLLUS; SALPACEA; SYNOICUM.]

The compound (and most probably all the) Ascidians, in their first state of development, after leaving the egg, assume the form of Tadpoles, and are locomotive by means of a vibratile tail, which they cast off when they quit the larva state and assume the sessile condition. This metamorphosis was observed by Sir John Graham Dalyell, both in a solitary and compound Ascidian, namely in *Ascidia papilla* (solitary) and in *Aplidium verrucosum* (compound). (See *Edinburgh New Philosophical Journal*, January, 1839, vol. 26, p. 152.) But in 1828 MM. Audouin and Milne Edwards had proved that the compound Ascidians are at their birth endowed with sufficiently extensive locomotive faculties, and that, in the progress of age, they underwent a true metamorphosis (*Ann. des Sciences Nat.*, 1828, tome xv., p. 10); and M. Sars, as well as Sir John Graham Dalyell, subsequently verified the fact, which had been doubted by certain naturalists. The observations of M. Sars were made upon the *Botrylli* of the Norwegian coasts. (*Beskrivelser og iagttagelser oder nogle mærkelige eller nye i habet bed den Bergenske kyst levende dyr af polypernes, acalephernes, radiathernes, annelidernes og molluskernes classer*, 4to., Bergen, 1835.) The metamorphosis of these animals is admirably described and figured in the beautifully illustrated paper by M. Milne Edwards, entitled '*Observations sur Les Ascidies composées des Cotes de La Manche*,' read before the French Academy of Sciences on the 11th November, 1839, wherein the structure and general physiology of these highly interesting animals is explained in a masterly manner. The researches of Savigny, of whom M. Milne Edwards speaks in those terms of eulogy which every zoologist must feel to be due to that acute, accurate, and patiently investigating naturalist, were principally employed upon animals preserved in spirits, which will account for the fact of some of their delicate organs having escaped his notice; for, as M. Milne Edwards truly observes, it is only by studying these small animals in the living state that one can hope to fill up the lacunæ which Savigny left in their history. This has been most satisfac-

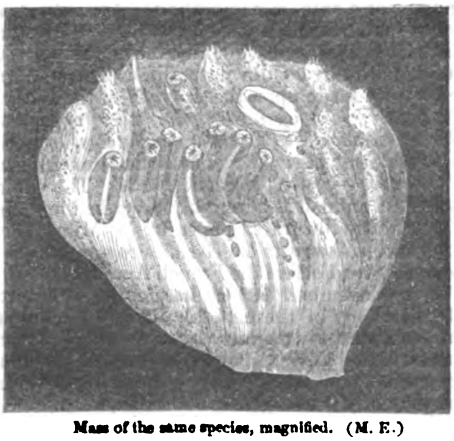


Tadpole of Amaroucium proliferum, newly hatched (highly magnified).

a, tegumentary body of the trunk seen within the pouch; b, pouch enclosing the vitellus, and forming the tunic of the body of the larva; b'', appendages terminating in suckers and enabling the animal to fix itself; a^*, tail formed by a prolongation of the tegumentary body, and enclosing a tubular appendage of the vitelline sac. (M. Edwards.)



Amaroucium proliferum: nat. size.



Mass of the same species, magnified. (M. E.)

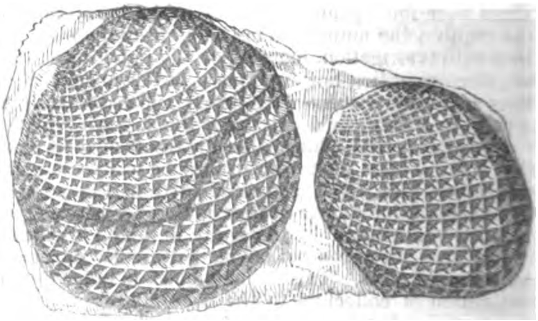
torily done by M. Milne Edwards, who established himself on the coasts of the Channel, where these *Ascidiæ* abound; and the results of his observations are embodied in the paper last quoted, which brings down the history of these animals to the present time, and most lucidly explains their organization and habits. We regret that our limits will not permit us to lay this excellent paper in detail before our readers. It is full of the most interesting information, and we recommend those among them who are observers to take this paper and their microscope with them to the coast, reminding them at the same time that when they have sufficiently amused themselves with examining the metamorphosis and organization of these Ascidians, they will find plenty of opportunities for adding to our stock of knowledge relative to the comparative anatomy and habits of a multitude of marine productions which demand an investigation and illustration like that bestowed by M. Milne Edwards on the Compound Ascidians.

Fossil Tunicata?

We would draw the attention of geologists to a more narrow investigation of the organic remains preserved in the various strata, and particularly in the older formations with a view to the detection of fossil animals belonging to this group. There is reason for believing that they were more plentiful than is generally supposed, and the test or envelope of many of them must have been capable of preservation. The forms themselves, presenting a low grade of organization, are just such examples of animal life as might be looked for in those beds which were once at the bottom of the antient seas, whilst they are found among the marine productions of the present day.

Here then we shall notice *Ischadites Königii*, from the lower Ludlow rock, described and figured in Mr. Murchison's 'Silurian System.'

Mr. Murchison remarks that these curious fossils are so grouped together, that he always compared them with packed or baked figs; and he says that Mr. König, to whom he referred them, thus speaks of them:—'I am of opinion that they may be considered to belong to the family of *Ascidiæ*. Like the *Leucophthalmus* of the 'Icones Sectiles' (cent. i., f. 1), they seem to form a group of globular, coriaceous, and, it may be added, pedicled bodies; for in one of them the cicatrix for the insertion of the pedicle distinctly appears. As however no traces of branchial and intestinal apertures are apparent on the surface exposed to view, it would be rash to constitute this fossil a genus, or to assign it a place in any of the known genera of the naked *Mollusca*, to which *Leucophthalmus* unquestionably belongs.'

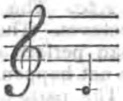


Ischadites Königii.

TUNING, the art of adjusting the several sounds of a musical instrument so as to make its scale approach to correctness; also that of putting two instruments, each of which has the parts of its scale in proper relative adjustment, into agreement with each other.

Some musical instruments have a permanent relative scale, all the parts of which, if changed at all, change together. Thus a horn or a flute may change its pitch from the heat of a room, but all the parts change together, and the whole effect of temperature is corrected at once by lengthening the pipe of which the instrument consists. Other instruments require to have the parts of their scales compared with each other from time to time, owing to their several parts being unconnected and subject to unequal wear or to separate accident: such as the organ and piano-forte. Others again are so liable to these derangements as to require tuning on every occasion of use, as the violin class, the harp, the drums, &c. It is not our intention to enter into the mode of tuning instruments in detail, but, as promised in the article SCALE, to give some account of the difficulties which are met with in the actual construction of any scale, and the ordinary modes of meeting them.

In the article just referred to we have pointed out the mathematical commencement of this subject, and have made it evident, from first principles, that *a perfect scale* is impossible; that is to say, one in which all the intervals, or even all the principal intervals, in every key, shall be perfect. Let additional notes be introduced to make existing keys perfect, and those additional notes would themselves become the key-notes of new keys, requiring additional notes to make *them* perfect. Again, the conditions of the ordinary musical instruments require that the octave shall consist of only twelve semitones, and though some organs have been constructed with more, it is not worth while to embarrass the subject by treating of any other scale than that of the twelve semitones. We shall use the same notation as before, namely, expressing the following note of the treble scale,



by c, we shall denote the successive cs in ascent by c^1, c^2, &c., and those in descent by c_1, c_2, &c.: thus c_3 is three octaves below c, and c^4 is four octaves above it.

The first point is to fix upon some one note, by the pitch of which all others may be determined. The only way of retaining a permanent pitch for use is by having an instrument which time will not alter. It is true that the pitch of a note depends only upon the number of vibrations in a second, and can, by the description of this number, always be recovered by acoustical experiments. But we might as well expect a carpenter to ascertain his own foot-rule for himself by the pendulum [STANDARD], as an ordinary musician to appeal to the theory of musical vibrations. A standard pitch is usually obtained, or professed to be obtained, by the tuning-fork, an instrument consisting of two steel prongs growing out of a steel handle. When these prongs are sharply struck they vibrate, and if the instrument be then held to the ear, or placed upon the flap of a table, or any other sound-board, a low and very pure sound is heard, if the prongs be perfectly equal. These tuning-forks are usually made to sound either c^1 or A, and they would answer their purpose exceedingly well if there really were in existence any standard from which they were made. But this there is not; and the consequence is, that not only do the tuning-forks of different makers frequently vary a little from each other, but the new forks are sensibly higher than the old ones. We have already seen how much the pitch used in different places varies [ACOUSTICS, p. 97], and also how very much what is now called concert-pitch is higher than it was a century ago [PIPE]. This rise, it appears, is still going on, and, unless measures are taken to stop it, will not finish until all the compositions of the old masters are played and sung two or three notes higher than they were really written.

There was, we are told, a few years ago, a standard, so called, constructed under the direction of those who manage the Philharmonic concerts; but we are not aware that any account was given of the method of selection, or that any experiments were instituted with a view to its perpetuation. We are also told that this mysterious standard was committed to the charge of one particular tradesman, and that the rest of the craft had difficulty in obtaining it. Since we began to write, we have seen another promulgation of a standard tuning-fork, for the especial use of singing-classes. The prospectus of the seller states that careful experiments have determined that the Philharmonic c (the c^1 of our notation) vibrates less than 512 times in a second; how much less is not stated. These new tuning-forks are asserted to have had their pitch raised to vibrate 512 times in a second; avowedly for no other reason than that 512 is a good number for calculation, and intermediate between those of tuning-forks now in use; and it is stated that every fork is tuned to the true standard by a 'scientific process.' But directors of concerts and publishers of music should be aware that no attention is ever paid by those who understand such matters to scientific secrets; and that until a full account is published, and authenticated copies of the standard are made secure and accessible, the science of the standard-makers will rank no higher than that of the tailors who cut 'on unerring geometrical principles.'

Mr. Woolhouse, who made the last experiments on this subject which were published ('Essay on Musical Intervals,' p. 64), finds the 'common pitch-note A' to make 424 double vibrations in a second, from whence he infers that c^1 gives 509 such vibrations: but whence he got this pitch-note he does not state, nor whether he was aware of the existence of a so-called Philharmonic standard. As matters stand, we should recommend every one not to be led into the belief of the existence of a standard without some better account of it than yet exists, and also in the mean time to do what he can to *keep down concert-pitch*, so as at least to prevent its rising higher than it now generally is.

There is another matter connected with the tuning-forks which requires some attention. These forks (in England —not on the Continent) are differently manufactured: there are C forks and A forks, that is, forks which sound c^1 and A. In the orchestra, which must follow the violins, the A fork is always used; while in tuning a piano-forte, harp, &c., the C fork is used. It is much to be wished that only one, the A fork, should be used. Even if the scale were perfect, it would still be desirable not to run the risk of error arising from the use of different forks; add to which, that without extreme care, such care as never is taken, it is impossible to avoid making the temperament depend somewhat upon the note which is first tuned, and which must be that sounded by the fork. We do not certainly much believe in the temperament of an orchestra; the characters of the instruments are various, and the disposition of most of the wind instruments to be a little out of tune, each in one or more particular parts of the scale, gives them each something so like a temperament (or distemperament, if the reader pleases) of its own, that the united body disobeys temperament to a degree which sets the slight differences between one system and another altogether aside. In the full passages there is too much noise for the ear to be very nice on this point, and in the solos the leading instrument marks its own temperament upon the whole orchestra. But when a few instruments come together, some of which are tuned from A and others from C, the disadvantage of different temperaments may be sensibly felt. But all this must be said with much deference, for circumstances connected with the scale or its adjustment may produce very different effects on different ears.

The leading note being settled, the tuner must learn to tune that note in perfect unison with his fork, and then to tune the octaves of that note both above and below. This seems to be the most plain and straightforward part of the whole operation: nevertheless, easily as tuners take it, and readily as they refer to one of their octaves as being as good an authority as the original note itself, we cannot help thinking that more pains than is usually taken might be well bestowed. A note and its octave, when the consonance is perfectly well tuned, should sound like one note: now considering that in a grand piano there are six strings to be tuned before an octave is ready, three unisons with the lower note and three with the upper, it is not so very easy to present that perfectly indivisible effect which a good artist ought to strive for. There is a method (given in Jousse's work) of tuning the twelve semitones of one octave-interval first, without tuning the octave of any note, by proceeding upwards by fifths and downwards by fourths, until the whole is completed, and this purposely to avoid depending upon notes in the adjacent octaves. This mode, however, or any other, must be matter of individual selection: it cannot be supposed that any one method would be best suited to all ears.

Those who are acquainted with the mathematical theory of the scale know that all the concords cannot be made perfect: others may learn it in the following way. Suppose twelve perfect fifths to be tuned upwards from C, and give the results the names of the notes which they would represent in the scale of twelve semitones, and in the nomenclature of sharps, if the scale were perfect. We should then have

C, G, D^1, A^1, E^2, B^2, $F^3\sharp$, $C^4\sharp$, $G^4\sharp$, $D^5\sharp$, $A^5\sharp$, $E^6\sharp$, $B^6\sharp$.

Now since $B^6\sharp$ is the same note as C^7, it appears that twelve perfect fifths should be the same as seven octaves; and if we pass to the octave below, as soon as we get out of the octave beginning with C, we should have C, G, D, A, E, &c. the last being C^1. It will be found however that this is not true, but that the note obtained from twelve ascents by fifths intermixed with six descents by octaves is sharper than C^1. Again, if the perfect thirds be tuned from C, we should have C, E, G♯, C^1, but it will be found that C^1 obtained in this way is too flat. The octave derived from the fifths vibrates 223 times where it should vibrate 220; and that derived from the thirds vibrates 125 times where it should vibrate 128. The slight alterations which are made in order that any one of the twelve notes of the octave may be fit to be used as a key-note, without any shock to the ear, constitute the *temperament* of a scale; the altered consonances are said to be *tempered*. Some writers call the interval from the false octave obtained by the fifths to the true one, by the name of the *wolf;* and using the word in this sense Lord Stanhope contends (and justly) for five *wolves*, one from the fifths, and one from each of the sets of thirds beginning with C, C♯, D, D♯; and three more might have been got from the minor thirds. But by the term *wolf* other writers mean the bad fifth which exists in the worst key, when the temperament is allowed to favour some keys at the expense of others. Simple as this little variation in the meaning of a term may be, it is worth while to notice it. A writer on tuning charges some of the pianoforte-makers of his time with utter ignorance of the scale, in stipulating with the tuners whom they employed that there should be no wolf. In all probability they only meant that no key should be worse than another, or that the temperament should be equal. This term *wolf* is said to be derived from the jarring of a badly-tuned consonance, supposed to resemble the distant howling of the animal: we rather suspect it was so called because it was hunted from one part of the scale to another like a wild beast, in hopes of getting rid of it.

Two systems of temperament suggest themselves: the first, *equal*, in which the necessary defects of the scale are distributed equally throughout it; the second, *unequal*, in which some mode is adopted of distributing the imperfection so as to make some keys feel it less than others. The most common practice of our day is to endeavour at equal temperament. The two systems have their advocates, and the arguments for one and the other are as follows. In favor of equal temperament it is urged that all the keys are made equally good, and that in no one does the imperfection amount to a striking defect: also that in the orchestra there is little chance of any uniform temperament among the various instruments, if it be not this one. Against equal temperament it is urged that it takes away all distinctive character from the different keys, and leaves no one single key perfect. All these arguments have force, both for and against: for ourselves, we consider those against equal temperament much the stronger. We have often felt that a pianoforte newly tuned has, with much correctness, a certain insipidity, which wears off as the effect of the tuning gradually disappears; insomuch that the best phase of the instrument, to our ears, is exhibited during the period which precedes its becoming offensively out of tune. At this time the progress towards the state of being out of tune (for which there is no single word, *maltonation* would do very well) can only be called a change of the temperament; and the several keys begin to exhibit varieties of character which, until maltonation arrives, render the instrument more and more agreeable. But it must be remarked with respect to equal temperament, that it cannot be obtained in the ordinary way of tuning. The only way of obtaining a given temperament, equal or unequal, with certainty, is to take a monochord, and having calculated the proper lengths of the different strings, to form the successive notes on the monochord, and to tune the several notes of the instrument in unison with them. No tuner can get an equal temperament by trial: so that the question lies between the having all sorts of approximations to equal temperament, according to the propensities of different ears, or as many sorts of approximations to some other systems. Had the English nation been as musical as it is mechanical, a portable monochord, or system of monochords, would have been invented, on which any given system of temperament could have been readily laid down by rule, and thence transferred to the instrument.

The mode of proceeding by approximation to equal temperament is simply to tune the fifths a little too flat, and the following order of proceeding is the most usual, and has often been given. The first letter represents the note already tuned, the second the one which is to be tuned from it: a chord interposed in parentheses represents the trial that should be made upon notes already in tune, in order to test the success of the operation as far as it has gone. The first step is to put C^1 in tune by the tuning-fork:—

C^1; C^{1}C; CG; GG$_1$; G$_1$D; DA; AA$_1$; A$_1$E; (CEG); EB; (CEB, DGB); BB$_1$; B$_1$F♯; (DF♯A); F♯F$_1$♯; F$_1$♯C♯; (A$_1$C♯E C♯G♯; (EG♯B); C^{1}F; (FAC^1); FA$_1$♯; (A$_1$♯DF); A$_1$♯A♯. A♯D♯; (D♯GA♯); D♯G$_1$♯; (G$_1$♯CD♯).

We have written all the semitones as sharps, whether tuned from above or from below. Of course, since the fifths are all to be a little too small in their intervals, the upper note must be flattened when tuned from below, and the lower note sharpened when tuned from above. In the preceding the octave CC^1 is completely tuned, and also the adjacent interval F$_1$♯C. The rest of the instrument is then to be tuned by octaves. The thirds should all come out a little sharper than perfect, as the several trials are made: when this does not happen, some of the preceding fifths are not equal. The parts which are first tuned by the fifths, and from which all the others are tuned by octaves, are called *bearings*.

We shall now show how, by means of the theory of the scale, to examine a system of temperament: the rest of this article is therefore only for those who have some mathematical knowledge of the scale. Everything will be expressed in mean semitones, and the following additions will be convenient. A major tone is 2·039100 mean semitones; a minor tone 1·824037; a diatonic semitone 1·117313; a comma ·215063; the excess of twelve perfect fifths above seven octaves ·234600, a little more than a comma, frequently called a comma; the excess of an octave above three perfect thirds ·410689. Various modes of dividing the octave have been proposed, that is, of creating imaginary subdivisions, by means of which to express the various intervals required. None is so convenient, in our opinion, as the expression by means of mean semitones and their fractions.

We prefer to show a complete examination of one system, in such a manner that any one may apply it to another, instead of briefly noting the peculiarities of different systems. We shall take as an example Dr. Young's first system, which is as follows:—Tune downwards, from the key-note, six perfect fifths, ascending into the octave interval CC^1 when necessary: then tune upwards, from the key-note, six equally imperfect fifths, throwing the whole error of ·2346 of a mean semitone equally among them. In the equal temperament the wolf is made to bear twelve cubs: here only six—larger ones of course. Now a perfect fifth, being two major tones, a minor tone, and a diatonic semitone, is thus composed:

Two major tones	4·078200	mean semitones
Minor tone	1·824037	
Diatonic semitone	1·117313	
Perfect fifth	7·019550	

The imperfect fifth of this temperament is to be flattened by the sixth part of ·234600, or ·039100, and 7·019550 − ·039100 is 6·980450, the imperfect fifth required. We are then to proceed as follows:—

Six fifths downwards perfect.			Six fifths upwards imperfect.		
	C^1	12·00000		C	0·00000
		7·01955			6·98045
1.	F	4·98045	1.	G	6·98045
	F^1	16·98045			6·98045
		7·01955		D^1	13·96090
2.	A♯	9·96090	2.	D	1·96090
		7·01955			6·98045
3.	D♯	2·94135	3.	A	8·94135
	D^1♯	14·94135			6·98045
		7·01955		E^1	15·92180
4.	G♯	7·92180	4.	E	3·92180
		7·01955			6·98045
5.	C♯	0·90225	5.	B	10·90225
	C^1♯	12·90225			6·98045
		7·01955		F^1♯	17·88270
6.	F♯	5·88270	6.	F♯	5·88270

There is no doubt, at least in this world,* much surplusage in carrying the results to five decimals, or the hundred-thousandth part of a mean semitone; but all calculators are aware of the desirableness of using more places than will ultimately be wanted. Collecting the above results, we have, for the interval of every note from C, as far as C^1, as follows:—

C	0·00000	E	3·92180	G♯	7·92180
C♯	0·90225	F	4·98045	A	8·94135
D	1·96090	F♯	5·88270	A♯	9·96090
D♯	2·94135	G	6·98045	B	10·90225

We shall now examine the effect upon the several keys. We have remarked [SCALE, p. 504] that the effect of making an interval too small is to render the consonance of a more plaintive character; while we may suppose that too large an interval has a somewhat contrary effect. As the most important chord of every key is that of the key-note, its third, and fifth, we must form our idea of the effect of each key from observing the effect of the temperament upon the common chord of the key-note, judging of the character of the key by the amount and direction of the temperament of the third and fifth. Now a major third is made of a major and minor tone, and is therefore 3·86314 mean semitones; while a minor third, or a major tone, and a diatonic semitone, is 3·15641 mean semitones. Hence the principal chord of a key, according as it is major or minor, has the following intervals from the key-note:—

Major 3·86314, 7·01955
Minor 3·15641, 7·01955

To examine any particular key, take out the numbers from the preceding table opposite to the notes of the principal chord (adding 12 to make the octave when necessary); subtract the number of the key-note from each of the other two, and the remainders will give the tempered intervals. Compare the tempered intervals with the preceding correct intervals, and the amount and direction of the temperament will be seen. For instance:—

	Key of A major.	
A 8·94135	C^1♯ 12·90225	E^1 15·92180
	8·94135	8·94135
Tempered intervals . .	3·96090	6·98045
Perfect intervals . . .	3·86314	7·01955
Temperaments . . .	+ ·09776	− ·03910

and + means sharper than perfect, − flatter than perfect. We might describe this chord (keeping three decimals, which is more than sufficient) as having a temperament expressed by the following symbol (+ ·098, − ·039); and if we examine all the keys in the same manner, we shall have the following account of this system of temperament. (A person who is used to the subject, and to calculation, might proceed more shortly by considering the law of the system, but the beginner had best take each key by itself. We have preserved the use of sharps only, for the sake of symmetry.)

Major Key.	Temperament.	Minor Key.	Temperament.
C, D, G	(+ ·059, − ·039)	A, B, E	(− ·098, − ·039)
C♯, F♯, G♯	(+ ·215, 0)	A♯, D♯, F	(− ·215, 0)
D♯	(+ ·176, 0)	C	(− ·215, − ·039)
E	(+ ·137, − ·039)	C♯	(− ·137, 0)
F	(+ ·098, 0)	D	(− ·137, − ·039)
A	(+ ·098, − ·039)	F♯	(− ·098, 0)
A♯	(+ ·137, 0)	G	(− ·176, − ·039)
B	(+ ·176, − ·039)	G♯	(− ·176, 0)

The rules for the verification of every such process are six in number, and as they express relations which may be made of signal use in searching for systems of temperament, we give them at length. In all these rules it is supposed that the fifths and minor thirds are tempered flat, the major thirds sharp, and that the signs are neglected.

1. The sum of the temperaments of all the fifths in the twelve keys must be the excess of twelve fifths above seven octaves, or ·23460 of a mean semitone.

2. The sum of the temperaments of all the thirds in the twelve major keys must be the excess of the octave above three major thirds taken four times, or 1·64236 mean semitones; the sum of the temperaments of the thirds in any three keys whose tonics are successive thirds being the excess above mentioned, or ·41059 of a mean semitone.

3. The sum of the temperaments of all the thirds in the twelve minor keys is three times the excess of four minor thirds over an octave, or 1·87695 mean semitones; the sum of the temperaments of the thirds in any four minor keys whose tonics are successive minor thirds being the excess above mentioned, or ·62565 of a mean semitone.

4. The temperament of the third in any major key, increased by the temperaments of the fifths *in that key and* the three succeeding dominant keys, makes a comma, or ·215063 of a mean semitone. The *dominant* of a note is the fifth above it; so that the successive dominant keys of C major, for instance, are those of G, D, A. Thus, in the above system, the temperament of the third in A♯ major is ·137, and those of the fifths in A♯, F, C, G, are 0, 0, ·039, ·039: put these together, and we have ·215, a comma, as asserted.

5. The temperament of the minor third in any key, together with the temperaments of the fifths *in the three succeeding* subdominant keys, make a comma, or ·21506 of a mean semitone. The subdominant of a note is the fourth above it; so that the successive subdominant keys of C, for instance, are those of F, A♯, D♯. Thus in the above system, the temperament of the third in A♯ minor, for instance, is ·215, and the temperaments of the fifths in D♯, G♯, C♯, are severally 0; these put together of course give ·215, a comma, as asserted.

6. The temperament of the flat seventh in any key is the difference of those of the fifth in that key and the minor third in the dominant key.

The algebraist may easily see how these rules are deduced, and also that they are all which can be obtained. They amount altogether to 25 equations of condition; for the first, fourth, and fifth rules contain the second, third, and sixth. Now, the pitch note c^1 being given, there are eleven notes to be determined, and there are 3 × 12 or 36 equations between the values of those notes and the temperaments of the major thirds, minor thirds, and fifths. But 36 equations between the eleven values of the notes should give 25 equations between the values of the temperaments; and these 25 equations are contained in our first, fourth, and fifth rules.

In every system of temperament which deserves the name, the fifths must be flattened, and also the minor thirds; while the major thirds must be sharpened. In any other case, the algebraist might use the preceding rules by considering as *negative* the temperament of a sharpened fifth or minor third, or of a flattened third. In this sense these rules are always true, from the instant when the strings of the instrument are put on, and throughout its existence as a sounding body.

It is now easy to determine the temperaments of the thirds, major and minor, from those of the fifths. From a comma subtract the sum of the temperaments of the fifths in any one key and the three following dominant keys, and the remainder will be the temperament of the major third in that key. Again, from a comma subtract the sum of the temperaments of the fifths in the three subdominant keys following any given key, and the remainder will be the temperament of the minor third in that key. Hence we may, without any trouble, lay down at pleasure the temperaments of the fifths, and deduce those of the thirds. But we cannot, from the temperaments of the thirds, deduce those of the fifths. It must be remembered that a succession of fifths, setting out from a given note, runs through every note of the scale before it reaches that note again; while the major thirds are brought up, so to speak, by the original note, in three successions, and the minor thirds in four. There are then four distinct parcels of major thirds, and three of minor ones, so that it is impossible to pass out of one into another by thirds alone. It would be possible to temper *all* the major thirds equally, and yet to retain an unlimited number of modes of tempering the fifths, depending upon the manner in which one system of thirds is joined on to the others; and the same of the minor thirds.

We have, from the scale, shown how to construct the temperaments: we now take the inverse question, namely, from the temperaments to construct the scale. Let the sharps be denoted by accents placed above the letters, thus A′ represents A♯, and so on. Let the temperaments of the fifths, in the several keys, be denoted by the small letters: thus *a* represents the temperament of the fifth in the key of A, or is the portion of a mean semitone by which the interval from A to E falls short of a perfect fifth. And, for abbreviation, let simple commas denote addition, thus a, b may mean $a + b$. Also let the notes themselves be descriptive of their intervals from C, thus C means 0; G′ means the interval between G♯ and C: we have, then, V meaning the number of mean semitones in a perfect fifth,

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* Mr. Marsh, the author of a treatise on tuning, is seriously of opinion that a perfect scale is one of the blessings reserved for a future state, in which 'it will be part of the enjoyment of the blessed to chant the praises of their Creator in extatic hallelujahs, *when systems of tuning shall no longer perplex us, and temperament shall be no more.*'

$C = 0$
$G = V - c$
$D = 2V - 12 - c, g$
$A = 3V - 12 - c, g, d$
$E = 4V - 24 - c, g, d, a$
$B = 5V - 24 - c, g, d, a, e$
$F' = 6V - 36 - c, g, d, a, e, b$
$C' = 7V - 48 - c, g, d, a, e, b, f'$
$G' = 8V - 48 - c, g, d, a, e, b, f', c'$
$D' = 9V - 60 - c, g, d, a, e, b, f', c', g'$
$A' = 10V - 60 - c, g, d, a, e, b, f', c', g', d'$
$F = 11V - 72 - c, g, d, a, e, b, f', c', g'\ d', a'$

That is, the interval from C to B, for example, is found by deducting from the excess of five perfect fifths above two octaves the sum of the temperaments of the fifths in the keys of C, G, D, A, and E. Towards the end, in isolated questions, trouble will be saved by remembering that the sum of all the temperaments of the fifths is ·2346 of a mean semitone, and that we thus have

$c, g, d, a, e, b, f', c', g', d', a', = \cdot2346 - f$
$c, g, d, a, e, b, f', c', g', d', \quad = \cdot2346 - f, a'$, &c.

We shall now take an example of this, and our instance shall be the proposal of a system of temperament which we should like much to see tried. We are for variety in the several keys, and against equal temperament; but we do not like variety without law. We do not like, for example, to find the greatest temperament in one key, and the least in an adjacent key, as that of the dominant or subdominant. Suppose then we ask what can be done towards an ascending and descending temperament, which, proceeding, say from the key of C, shall increase through the keys of C, G, D, A, E, B, and diminish through those of F′, C′, G′, D′, A′, F. And as a first step, let the increments and decrements of the temperaments of the fifths be equal, or let $c = m$, $g = 2m$, $d = 3m$, $a = 4m$, $e = 5m$, $b = 6m$, $f' = 7m$, $c' = 6m$, $g' = 5m$, $d' = 4m$, $a' = 3m$, $f = 2m$. Here, as far as the fifths are concerned, the effect of modulation into the dominant or subdominant keys is the same everywhere, as much as in equal temperament. And, from the first rule, we have $48m = \cdot2346$, or $m = \cdot0048875$, and the greatest temperament of a fifth is seven times this, or ·034. Now if we compute the temperaments of the thirds, major and minor, from the fourth and fifth rules, we may exhibit the temperaments of all the keys, as follows:—

Key.	Temperament.			Key.	Temperament.		
	−	+	−		−	+	−
C	·186	·166	·005	F♯	·127	·108	·034
G	·191	·147	·010	C♯	·122	·127	·029
D	·186	·127	·015	G♯	·127	·147	·024
A	·171	·108	·020	D♯	·142	·166	·020
E	·156	·098	·024	A♯	·156	·176	·015
B	·142	·098	·029	F	·171	·176	·010

The three columns contain the temperaments of the minor third, major third, and fifth. The effects of modulation into adjacent keys are everywhere very small, nowhere amounting to more than about the tenth of a comma, in alteration of temperament; while the fifths are in different keys so differently tempered, that in C that interval may be called perfect, while in F♯ there is nearly twice as much temperament as in the equal semitone system. There is then variety without sudden change. In the system of equal semitones, the temperaments of the minor third, major third, and fifth, are always

$$- \cdot156, + \cdot137, - \cdot020$$

Now to form the scale in this system. Proceeding by the table given above, of which we take a few steps as an example, we have,

$C = 0\cdot000000$
$V = 7\cdot019550$
$\ 7\cdot019550$
$c = m = \ \cdot004888$
$A = 7\cdot014662$
$V = 7\cdot019550$
$\ 2\cdot034212^{*}$
$a = 2m = \ \cdot009775$
$D = 2\cdot024437$, &c.

Proceeding in this way, we find for the intervals of the several semitones from the key note, expressed in mean semitones, the following table:

C	0·000	E	4·029	G♯	7·990
C♯	1·000	F	4·990	A	9·029
D	2·024	F♯	6·015	A♯	9·985
D♯	2·985	G	7·015	B	11·024

To carry this or any other system strictly into practice without comparisons with the monochord, or the use of beats, presently described, would be impossible; but the following might be suggested as an approximation. In tuning by fifths, let the intervals C G and F C be made perfect, or all but perfect; let there be greater temperament in G D, D A, and D♯ A♯, A♯ F; and most of all, decidedly, in the remaining intervals.

The system of temperament is sometimes described by giving the number of vibrations made by the several semitones, or numbers proportional to them. It is easy enough to deduce the number of mean semitones in each interval from such data, either by the common tables of logarithms or by that given in SCALE.

First, by the common table of logarithms. From the logarithm of the number answering to the higher note, subtract that answering to the lower; from the result take its three-hundredth part, and multiply the remainder by 40. The product is the number of mean semitones in the interval, with an excess of very little more than the thousandth of a mean semitone in an octave. For example, to find the intervals, in mean semitones, of a fifth and of a comma, in the former of which the lower note makes two vibrations while the higher makes three, and in the latter 80, while the higher makes 81:

For the Fifth.		For the Comma.	
log. 3 =	·47712	log. 81 =	1·90849
log. 2 =	·30103	log. 80 =	1·90309
300)	·17609	300)	·00540
	·00059		·00002
	·17550		·00538
	40		40
Result	7·02	Result	·2152
More exactly	7·01955	More exactly	·2151
Error	0·00045	Error	·0001

Next, by the table in SCALE (p. 506). If the numbers be in the table, simply subtract the logarithm of the lower number from that of the higher, and the result is the answer required, within about the hundredth of a mean semitone. But if the numbers be not in the table, divide both by any number which will bring them within the table, accurately or approximately, and then subtract as before: interpolation may of course be employed, but if the skill of the computer does not reach so far, he must be content with a less accurate result, or must use the common table in the manner just explained. For instance, one note makes 4622 vibrations, while another makes 5033; required the interval between them. Divide both by 30, which gives 154·1 and 167·8; if without interpolation, say 154 and 168. Opposite to 168 is 88·70, and opposite to 154 is 87·20, differing by 1·5, or a mean semitone and a half. The interpolated logarithms are 88·68 and 87·21, differing by 1·47. The more accurate result of the former rule is 1·4752.

The tuning of a piano-forte is generally done by ear, but in that of an organ, recourse is had to the beats which imperfect consonances always give. In the temperament of this last-named king of instruments, less liberty is allowable that in that of the stringed instruments: for not only do the beats become unpleasantly frequent when a consonance is too imperfect, but the imperfection of the consonance itself is more perceptible when notes are held, as in the organ, than when they die rapidly away, as in the piano-forte. These beats are described in ACOUSTICS (p. 97), and when the lower note is known, and also its number of vibrations, the number of beats which are made in a given time, as ten seconds, a minute, or any other which is convenient, can be calculated from the known imperfection of the consonance, and the number of vibrations of the lower note. Theoretically speaking, it makes some little difference whether the consonance is tempered sharp or flat, but not to an extent which it is worth while to consider. The rule for determining the beats is as follows: let the lower note of the (perfect) consonance make n vibrations while the upper note makes m, the fraction $m \div n$ being in its lowest terms, and let N and M be the actual numbers of vibrations in the lower and higher notes, per second: then $m\text{N} = n\text{M}$. Let μ be the fraction of a mean semitone by which the consonance is tempered; then the number of beats in a minute is found by taking the fraction μ of the production mN or nM, multiplying by 1109 and dividing by 320, or by 4, 8, and 10. The algebraical formula is,

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* Throw out the twelves as fast as they arise.

$$\frac{1109}{320}\,\mu\, m\,\text{N} \text{ or } \frac{1109}{320}\,\mu\, n\,\text{M} \left(\frac{1109}{320} = 3\cdot4656\right)$$

For example, let the note c^1 make 512 vibrations, it is required to find the number of beats per minute in the consonance c^1G^1, when tempered as in the system of mean semitones. Here $\text{N} = 512$, $m = 3$, $m\text{N} = 1536$. The perfect fifth is 7·01955 mean semitones, whence the fraction μ is ·01955, since the tempered fifth has seven semitones exactly. Multiply ·01955 by 1536, which gives 30·0288; multiply by 1109 and divide by 320, which gives 104·07 (say 104) beats in a minute.

Tables for facilitating the calculation might easily be made, but it is hardly worth while to insert them here. These beats are usually, we believe, simply counted with a watch, but it would be both convenient and exact to have some such machine as Dr. Smith recommended, a pendulum which could be easily altered in vibration, and first adjusted to move exactly with the beats; the pendulum might then be subsequently compared with the watch. Without such a contrivance it is very difficult to tune the piano-forte by beats, since they do not last long enough in sufficient intensity; with it the last-named instrument might easily be tuned on any system of temperament, and those who practice the art would have the advantage of hearing different systems, knowing at the same time what those systems are. At present the organ-builder is the only tuner who makes any approach to science: all the rest judge only by the ear, which may vary from time to time, or even with the state of the body, or the weather. We have many reasons for thinking that the ear alone is a variable judge in so nice a matter as temperament.

Persons desirous of information on this subject may consult Jousse *On Temperament*, London, 1832; Hamilton, *Introduction to the Art of Tuning* (no date); Stanhope, *Principles of Tuning*, 1806; Marsh, *Theory of Harmonics*, 1809; Woolhouse, *On Musical Intervals*, 1835; Sir J. Herschel, *On Sound* (Encyclop. Metropol.); Young's *Lectures*, vol. i., cap. 33; Smith *On Harmonics*, first edition, 1749; second edition, 1759. This work of Dr. Smith is most difficult and confused, but is still the most extensive separate treatise on the subject; that of Mr. Woolhouse is sufficient, and much more intelligible.

TUNIS, one of the Barbary states or regencies, situated in the central part of the northern coast of Africa. It is bounded on the north and east by the Mediterranean Sea, on the west by the territory of Constantina, and on the south by the Beled-el-Jerid, or the 'country of palm-trees.' Its greatest extent from north to south, where the boundary-line is very undefined, is about 300 miles, while its breadth from west to east varies from 65 to 140 miles. The average width may be about 100 miles, so that the area of Tunis will be 30,000 square miles, or about 3000 square miles more than that of Ireland. In this rough estimate the country south of 33° N. lat., which is part of the Sahara, and in which the authority of the Bey seems to be only nominal, has not been included.

Occupying the countries formerly known as Zeugitana and Byzacium, and projecting towards the centre of the Mediterranean to within 80 miles of Sicily, Tunis is the most important of all the countries of Northern Africa, not only on account of its position, but for the ports it possesses on a coast measuring in a sailing line about 400 miles. These advantages made its inhabitants a warlike and commercial people in the time of the Carthaginians, the terror of Rome in the height of her power, the strength of the barbarians and Saracens against Southern Europe in the middle ages, and an unceasing annoyance to the Christian states after it fell into the hands of the Moslem pirates in the sixteenth century.

The northern portion of the country, or that which is situated north of 36° N. lat., exhibits in general a hilly character, and rises in some parts into mountains of considerable elevation, though there are also several plains of some extent. In the southern districts however, which comprehend more than three-fourths of the area, a level character prevails, and such ridges as occur are neither extensive nor elevated, with the exception of the Jebel Ussalat.

The frontier between the Algerine possessions and the state of Tunis has sometimes varied, but is now marked by the small rivulet of Wad-el-Erk, in 8° 32′ E. long., whilst the boundary of Numidia and Africa Propria, the antient names of these provinces, was defined by the Tusca, according to D'Anville, which falls into the Bay of Tabarca 12 miles farther to the eastward. Indeed this seems to have been considered the boundary of the modern states when Dr. Shaw wrote his 'Travels, or Observations on Barbary and the Levant' (London, 1757). The little island of Tabarca, once possessed by the Genoese, lies in the innermost part of this bay, five or six hundred yards from the mainland. The capes and headlands of this coast are variously laid down by geographers. The map of the Chevalier Lapie (Paris, 1829) seems to be most carefully compiled as a map; the best authority for the coast-line and soundings is the Admiralty Chart from the surveys of Captain W. H. Smyth (1821). According to these authorities, starting from Tabarca towards the north-east, and passing Cape Negro and Cape Serrat (Ras-el-Munshikhar), we arrive at Cape Krun, 58 miles from the frontier, in 37° 20′ 10″ N. lat. About 8 miles due east Cape Blanco (Ras el-Abeadk), the Candidum Promontorium of Pliny, stretches forth in 37° 19′ 50″ N. lat. The trifling difference between the latitudes of these two capes may account for sometimes the one and sometimes the other appearing as the most advanced point of Africa northward on the common maps.

Sea-coast.—The northern coast, from the boundary-line of Tunis and Algiers to Ras Sidi Ali-el-Mekki, or Cape Farina, is rocky and high. The western part of it, as far as Ras-al-Mun-shikhar, or Cape Serat, is steep, and the mountains near it rise to a considerable elevation: it is also mostly wooded, but east of that promontory the coast is much lower, and in many parts considerable tracts of barren sand extend from the summits of the hills to the water's edge. The most eastern portion, which lies east of Ras Sidi Booshusha, or Cape Zibeeb, contains only hills, most of which are covered with large plantations of olives, between which there are a few tracts of yellow sand.

The coast here takes a sudden direction to the southward into the Bay of Biserta, and we immediately fall upon the once fortified town of that name, called by the natives Benzart, the Hippo-Zarytus of the antients, situated upon a narrow channel which connects the waters of two magnificent lakes with the sea. It was formerly the safest seaport of Northern Africa, and was a great naval station of the Barbary corsairs; but the channel is now choked up by neglect, and the town, although governed by an agha, and containing ten or twelve thousand people, presents the miserable remains of a place which flourished at no very remote period. Its white towers however produce a picturesque effect in the beautiful landscape and rich country that surround them. Farther to the east, about 10 miles, is the headland called Ras Zibeeb; and 14 miles beyond this Cape Farina (sometimes called Capo di Guardia, but by Shaw erroneously Ras Zibeeb), the Promontorium Apollinis of the antients, forms the western limit of the great Gulf of Tunis: its Moorish name is Ras Sidi Ali-el-Mekki.

The coast of the Bay of Tunis, from Ras Sidi Ali-el-Mekki to Ras Ghamart, is low and generally swampy. But along that projecting tract on which the ruins of Carthage are found the coast is rocky, though in general slightly elevated above the sea. The shores of the innermost recess of the Bay of Tunis, between Ras Sidi Boosaid to Maraish, near Ras Zafran, are low, and in many parts marshy. From Ras Zafran to Ras Addar, or Cape Bon, and thence to Ras Mustapha, the coast is alternately rocky and high, and low and swampy.

A few miles within Ras Sidi Ali-el-Mekki the river Majerdah, the antient Bagradas, falls into the sea through a lagoon, commonly called Port Farina, upon which stands the town of Ghar-el-Milah, once populous, with its ports, moles, dockyard, and arsenal; where, no longer ago than the beginning of the present century, large frigates rode at anchor: but the decline of the Moorish power and the filling up of the port by the alluvium of the river have left it a deserted place, more wretched than Biserta. Crossing the Gulf of Tunis and passing the two small islands of

Zembræ, or, as the Moors call them, Zowamores, which lie at the entrance of the gulf, near to its eastern limit, we find ourselves at Cape Bon (Ras Addar), the Promontorium Mercurii of the antients. This cape forms the eastern extremity of the gulf, and the eastern point of the Tunisine territory; for the coast here takes a sudden direction to the south, as far as Ras-el-Zargiss, the frontier of the kingdom of Tripoli.

From Ras Mustapha to Ras-el-Mahmoor the coast is low and generally swampy, being formed by the alluvial deposit brought down from the adjacent hills by numerous torrents. A tract of low and rocky coast extends from Ras-el-Mahmoor to Hammamet, and it is followed by a low sandy coast, which occupies the interior of the Bay of Hammamet, and terminates near Susa. There is a considerable lagoon connected with the sea near Hercla. From Susa to Ras Capoodia (the antient Caput Vada), and thence to the town of Sfakkur, the shores are in general rocky, but not high; in a few places they are low and sandy. Between Lambta and Tobulba is another *sibha*, or lagoon, which is not connected with the sea. It is three miles long and half a mile wide. Salt is collected there to a large amount.

Hammamet, which gives its name to the gulf, is a town of about 4000 inhabitants, the cleanest and neatest in the regency. It is the capital of an agricultural district of 15,000 souls. Not far from it stands Hercla, the Heraclea of the lower empire, and, according to Shaw, the Adrumetum of former ages. But Sir Grenville Temple, in his 'Excursions in the Mediterranean' (London, 1835,) adduces strong grounds for believing that Susa was the antient Adrumetum, and the capital of the rich and fertile region of Byzacium. With its battlements, castles, and mosques, Susa still presents from the sea a pleasing appearance, and is a place of considerable commerce, and one of the wealthy cities of the Tunisine state, being the chief mart for oil, linen, and soap: it has about 6000 inhabitants. The ruins of the antient harbour are clearly traceable under water, and at the present day it has a mole, and good anchorage in 7, 9, and 10 fathoms, secure from all winds except the north-east. The castle appears to be kept in good order, and in 1537 the place resisted a regular siege by a combined Spanish and Maltese naval force, which was obliged to retire after a breach was made. Passing the modern town of Mistir, or Monastir, which is walled in and fortified, but has no safe anchorage, and the village of Lampta, the Leptis Parva of antiquity (which, whatever may have been its wealth, according to Pliny, and its safety as a port, according to Lucan, is now an insignificant place), we arrive at Cape Demas, the southern limit of the Gulf of Hammamet. Here are the remains of the once large and powerful town of Thapsus, whose solid mole is yet partly in existence. Mahadeah, called also Africa by the moderns, and Turris Hannibalis by the antients, stands on a point of land about nine miles to the southward of Cape Demas. It was a place of great strength and importance in the sixteenth century, and was taken and retaken frequently in the warfare waged so fiercely against the Moors by Charles V.,.who, finding it to be the stronghold of the corsair Dragut, expended much money and much Christian blood to possess himself of it; but after having taken the place, he abandoned it, and destroyed its works, the remains of which show that they were of great solidity. The inner harbour, which was within the fortifications, is now quite dry; and it is in fact a poor place, available neither for war nor commerce. About 21 miles farther to the south, bounded by Cape Capudiah, the Caput Vada of Procopius, on the north, and the island of Gerba on the south, opens the Gulf of Cabes, or the Little Syrtis. Among the towns on its shores is Sfax, or Sfakkus, the antient Taphræ, or Taphura, where there is a mole, and good anchorage, although the approach to it is intricate, by reason of the Karkenna islands and innumerable low rocks which run for miles along this coast. It was formerly a great nest for pirates, but is now a mart for inland produce and European as well as Eastern merchandise, in which it carries on a brisk commerce; the inhabitants, amounting to 12,000, are a thriving and rich people. Farther to the south, on the bank of a small river, is the town and small port of Gabs, or Cabes, from which the gulf takes its modern name. The town stands about a mile from the sea. It is supposed that Tacape, or Epichus, once stood near this site. Gerba, the Meninx of Strabo and Pliny, is a considerable and populous island. Its greatest curiosity is a tower constructed of human skulls, said to be those of 1400 Christians belonging to some Sicilian and Maltese galleys, who were taken in an attack upon the place in 1605. The inhabitants of Gerba manufacture shawls of brilliant colours, and fabrics of a beautiful texture made of silk and fine wool, which are worn by all persons of rank in the regency: they also manufacture the common cloak called bernoose, and a sort of woollen blanket, which is light and warm, and used by the lower orders.

The shores of the Gulf of Gabs to the vicinity of the island of Gerba are very little above the sea-level, and in general sandy, rocks or cliffs of small extent being only found in a few places. Not far from the island of Gerba the coast rises to a moderate elevation and continues so to the boundary of Tripoli. There is a considerable lagoon called Sibha Gatayah, in the Bay of Gabs, south of Al Nadoor.

The Gulf of Cabes seems to have undergone great changes, and by no means resembles the Minor Syrtis of the antients, which, according to Scylax, was the more dangerous of the two. In this part of the Mediterranean it seems to be established that there is a tide or rise of the sea, which is variously stated at three and five feet, and near the island of Gerba it amounts to even ten feet, as observed by Sir Grenville Temple in 1832. This rise is accounted for by the sudden opposition which the sea receives from the eastern coast of Tunis, and its lateral compression caused by the island of Sicily. The danger of the Minor Syrtis therefore arose not so much from quicksands and whirlpools as from the variations and uncertainty of the tides on a flat shelvy coast. From Caput Vada to the island of Gerba lie a number of little flat islands, banks of sand, oozy bottoms, and small depths of water, which make its navigation intricate and difficult to strangers, but easy to the natives who know its channels and innumerable windings. The gulf is not more than 75 miles in extent from its northern to its southern point, and it penetrates into the mainland about 60 miles. But Major Rennell, after a patient examination of Herodotus, Ptolemy, Pliny, Scylax, and every other author who has written upon the geography of this part of the world, comes to the conclusion that it at one time entered deeper into the land, and formed a junction with the lake Lowdeah, called also the lake of Marks, the Tritonis Palus of the antients; and he confirms this opinion from Dr. Shaw's account of them, who says that the land between the east end of the lake and the inmost recess of the Syrtis is flat and little elevated above the level of the sea, and that the space between them is about 22 miles in length and 10 or 12 in breadth. He describes the land also to have gained and to be still gaining on the sea at Cabes, where the antient town of Tacape is left half a mile inland. Nothing appears more probable than that such a change should have taken place in a situation where the continued operation of the sea is depositing sand on a flat coast where there is no backwater to sweep it into the sea again. If the lake and the gulf were separated from each other by a bar of sand only, the perils of the Syrtis would naturally be deemed by the antients greater than they are at present. In modern times the Gulf of Cabes is not spoken of by mariners with particular alarm, as is proved by the number of small vessels which carry on a trade in every season between Sfax, and the ports of Sicily, Malta, Alexandria, and the Levant. And in fact M. de Châteaubriand (*Travels*, vol. ii.), who took refuge here in a storm in 1807, says that the sea, from the shallowness of the water in the Minor Syrtis, is calm in the most violent winds; and that this gulf, so dangerous to the barks of the antients, is a sort of port in the open sea for modern vessels.

The Interior.—Tunis is so situated that it is never traversed by Europeans as the highroad between one country and another. It is only therefore from those enterprising individuals who have, at no small personal risk, passed through it for the purpose of describing it, that we can know anything of its interior provinces. Thus Dr. Possonel, at the expense of the king of France, made a survey of a great part of these territories in 1726. Dr. Shaw, whose very elaborate work has been already mentioned, passed through it in several directions in 1727-28. Bruce, in 1765-66, previous to exploring the Nile, remained six months encamped in many parts of this country, and made a vast number of drawings of remarkable objects of antiquity. The Abbé Poiret, in 1785-86, made several journeys from the French settlement of La Calle through the northern and western parts of the regency of Tunis, and collected much valuable information in natural history and on the mode of life of the Arabs, which he published in his 'Voyage en Barbarie' (Paris, 1789); the 'Excursions of Sir Grenville Temple,' were published in 1832-33; and Prince Puckler Muskaw published his 'Semilasso in Africa' in 1837. From these works and other information we proceed to give some account of the country.

During the Roman dominion that part of this rich country known by the name of Byzacium, although by no means the most fertile district at present, was called, from its extraordinary productivenesss, the Emporium, and vast quantities of grain were exported to different parts of the Roman empire; but now grain is frequently imported into the Tunisian territory, so discouraging is the system of administration, which overreaches its own interest by coveting all surplus produce. No person therefore cultivates more land than is barely sufficient for his subsistence, the exactions upon him being regulated by a regard to the amount of his store over and above the wants of his family and dependants.

There are no made roads, and the tracks are often dubiously indicated; nor are there any stations or inns, so that the traveller is obliged to go rambling about in hopes of espying a dowar, or group of Arab tents; which being formed of a cloth made of goats' hair, stretched over a horizontal pole, look like capsized boats at a distance. Here he may pass the night, and perhaps obtain food for himself and animals. But whatever will keep good and wholesome he should carry with him, for nothing is to be bought in the country. He is generally accompanied by three or four *spahees*, or cavalry-guards, granted to him by the Bey, who authoritatively demand supplies from the inhabitants. The inhabitants are obliged, either by long custom or the particular tenure of their lands, or oftener from fear and compulsion, to comply with such requisitions, on which account the Arabs seek secluded spots for their encampments, but they are easily discovered by the smoke of their fires. The country throughout presents no sign of present civilization; its scanty population must be sought for; immense tracks lie untilled and unowned, which, in the hands of an industrious and well-governed people, might be converted into valuable possessions.

Surface and Soil.—The north-western portion of Tunis, or that which is enclosed by the boundary-line of Algiers on the west, the valley of the Majerdah river on the south and east, and the Mediterranean on the north, is very mountainous. A range of mountains, extending near 36° 30′ N. lat., west and east, enters Tunis near 8° 40′ E. long., and spreads over the whole district. The most elevated part of this range is at the distance of a few miles from the banks of the river Majerdah, where it runs from west to east, and is called the Frigean range, from a district called Frigea, in which it is situated, and which, according to Shaw, who says that it extends over the upper valley of the Majerdah and the mountain-range from Kaff to Bai-jah (Beja of our maps), is one of the most fertile and populous districts of the regency. The mountains probably do not exceed 4000 or 5000 feet above the sea, and their sides are generally covered with fine trees. The lower hills, which surround the more elevated portion of the range, are partly cultivated and partly covered with olive-plantations, more especially in the upper valley of the Wady Zain, where the mountains which lie east of it contain rich lead-mines. Near 9° 20′ E. long. the Frigean range turns to the north, and forms a wide-spread mass of rocks of moderate elevation, which is divided into two parts by a small river that falls into the lake of Benzart, and drains a narrow valley. The extensive mountain-mass which lies west of this valley is a table-land, which descends with rather a steep declivity towards the Mediterranean. It is called Mogody, and its upper part is covered with shrubs and brushwood, and is without cultivation. But where it declines towards the lake of Benzart it is well wooded, and near its base planted with olive-trees. The lake or rather lakes of Benzart (for the lake is divided into two parts by a projecting promontory) extend from northeast to south-west 28 miles; the greatest breadth is 14 miles. The lakes are connected with the sea by a channel about 10 miles long, which near the town of Benzart is little more than one fathom deep, but above it increases in depth to six and ten fathoms. The depth of the northern lake varies from 10 to 60 fathoms water. It abounds in several kinds of fish, among which is the grey mullet, from the roe of which is made the famous botarga of Benzart, which is much more delicate and of a finer flavour than any other. The fish is sent to Tunis. The lakes are surrounded by a level tract one or two miles in width, partly cultivated, but chiefly planted with olive and fruit trees. The peaches of Benzart are in great repute. That part of the Frigean mountains which lies east of the valley and lakes of Benzart rises only into hills. It contains a portion of cultivable land and many olive-plantations.

The river Majerdah rises within the territories of Algiers, where it is formed by the junction of the waters of the Wady Serrat and those of the Wady Khamees or Hamiz. The Serrat rises in that part of the Atlas mountains which is called Jebel Nemenshah, near 35° N. lat., and runs north-north-west to 36° 10′ N. lat., where it is joined by the Wady Khamees, at which point the united river enters the territory of Tunis. The water of the Serrat is brackish. As far as the Majerdah runs eastward the valley is of moderate extent, and frequently interrupted by spurs from the adjacent hills and mountains, but soon after it has begun to run north-north-east it emerges from the hills and runs through a plain of considerable width. It flows in a deep bed in a light sandy soil, and is constantly changing its direction when the waters are high. Unless swelled by rains its lower course is sluggish, not exceeding a mile an hour; and it probably could be navigated by boats at least for the greater part of the year, which however does not appear to be the case. Near the mouth of the river is a wide plain, partly occupied by lakes, which have been formed by the inundations of the river. This plain, along the lower part of its course, is of moderate fertility, and only partially cultivated.

According to Shaw, an uninterrupted tract of elevated ground traverses the country in a diagonal line between 35° and 37° N. lat., beginning on the south-west on the boundary-line of Algiers, west of the town of Kazareen, and terminating on the north-east in the peninsula of Dakhul and Ras Addar. This tract appears in most places to attain only a moderate elevation above its base, but at a few parts it rises to a considerable height, as in the Jebel Truzza, Jebel Ussalat, Jebel Zunghar, and Jebel Zaghwan. The elevation of none of these higher portions has been determined by actual measurement, and they are otherwise very imperfectly known. In many parts they are covered with pine-forests, and a large quantity of tar and pitch is made. Another chain of heights, called Jebel-al-Kaff, runs across the country from west to east, near 36° N. lat., beginning west of Al Kaff, and joining the former range at Mount Zunghar, near a point where the parallel of 36° is cut by 10° E. long. This chain appears to consist of single mountain-masses, frequently separated by deep depressions or valleys, through which some of the tributaries of the Majerdah flow to the principal river. Some of its summits towards the west are very high. It is in many parts well wooded, especially on the lower declivities and in the valleys.

Between the valley of the Lower Majerdah and that portion of the first-mentioned mountain-range which extends from Jebel Zunghar to Ras Addar, lies the plain of Tunis, which extends 20 miles on the north and west side of the town, but to double that distance towards the south. It is far from being level; in several places there are extensive rocky tracts 300 or 400 feet above the sea-level, as for instance that on which the ruins of Carthage are scattered. In other parts there are short isolated ranges, but between them are also level tracts of considerable extent. This plain is not distinguished by fertility, for large tracts have a rocky soil, and others are covered with stunted trees, but it is better cultivated than any other part of the regency, and more populous, which is owing to a large commercial and populous town being situated nearly in its centre.

The Dakhul, or the peninsula which lies east of the Bay of Tunis, is nearly occupied by the range which extends from Jebel Zaghwan to Ras Addar. In this range occur two deep depression of inconsiderable width. Through the southern depressions the road is made which leads from Tunis to Nabal and Hammamet. The northern depression occurs near the northern extremity of the peninsula, where a low plain unites the large and elevated masses forming Ras Addar with the continent. The Dakhul is noted for its fertility; but the interior, as far as it has been seen by travellers, appears to consist of naked rocky masses with little vegetation on them. Only the level tract, which lies along its eastern side, exhibits any great degree of fertility. It is from two to three miles wide, and consists of alluvium, which has been brought down by numerous torrents from the mountains and deposited at their base. This tract is well cultivated, and produces abundant crops of grain, and the fields are interspersed with villages surrounded by groves of olive-trees and orchards, in which fig-trees are common. The adjacent hills have excellent pasture for cattle, which are numerous. The dairies are well attended to. The western shores of the Dakhul are far from being fertile: a great part of this tract is covered with rocks, and the remainder is not very productive. North of the Jebel Zaghwan there are some lead-mines.

The countries hitherto noticed may be considered as the agricultural part of Tunis. The greater part of the inhabitants are exclusively or chiefly engaged in cultivating the ground and in planting olive-trees and orchards. In some parts these occupations are united with the rearing of cattle and attending to the dairy. They all live in fixed habitations, with the exception of a few families of Arabs, who ramble about with their herds in the southern and more sterile districts of the plain of Tunis. In the countries farther to the south however the bulk of the population consists of wandering tribes, who only occasionally cultivate a few patches of ground. There are indeed in several places extensive tracts on which agriculture or horticulture is carried on with success, but these tracts constitute a very small proportion of the whole country.

The region which is separated on the north from the upper valley of the Majerdah by the Al Kaff Mountains, and extends southward to 35° N. lat. and eastwards to Jebel Ussalat (10° E. long.), is very imperfectly known. As far as can be inferred from the accounts of the few travellers who have traversed it, this region consists of an alternation of hills and of plains of considerable extent. Some of the hills are connected so as to form long ridges; others are isolated. Part of them are wooded, especially in the valleys and glens which intersect them, and these valleys contain the small tracts which are cultivated by the Arabs. The plains are entirely without cultivation, and serve only as pasture-grounds for sheep and camels. This region has no towns and very few villages. The Arabs live in dowars, or clusters of tents. The numerous ruins of large towns which are dispersed over it show that a considerable portion of this tract was once cultivated. This country must be considerably elevated above the sea-level, as frost appears to be common in winter.

To the east of this region lies the plain of Kerwan, which extends from the innermost recess of the Gulf of Hammamet to the town of Sfax. Nearly in the middle of this plain, which is more than 100 miles in length and about 30 miles in width, the town is situated from which its name is derived. The surface is stated to be almost a continual level, which is rarely interrupted by single hills; but the degree of cold which is experienced in the town of Kerwan proves that this place must be considerably above the sea. The plain is destitute of trees, and nearly without cultivation, except in the immediate vicinity of the town, where a large tract is sown with several kinds of grain. The Arab tribes who wander about in it find abundant pasture for their camels and horses, and appear to be much more wealthy than the other Arab tribes in Tunis. They sow small tracts with barley and pulse.

The plain of Kerwan reaches to the shores of the sea between Hammamet and Susa, but farther south it is separated from the sea by hilly tracts, which extend from the town of Susa southward to a point opposite the islands of Karkenah. This tract may be about 24 miles in width in the widest part, as it approaches on the west the ruins called Al Jem. The interior of this region is composed of a succession of sterile hills; but the eastern border, and the low tract which lies between it and the sea-shore, are tolerably fertile, though the soil is stony. It is chiefly planted with olive-trees, which frequently form forests many miles long and from two to three miles wide. This coast has several sea-ports, from which oil, wool, and wax are exported: the two last-mentioned articles are brought by the Arabs from the interior. At the most southern extremity of this region is the town of Sfax, whose olive-plantations extend 10 or 12 miles along the sea-coast from 5 to 6 miles inland, and are intermingled with groves of pistachia-nuts, and fields of rye, barley, maize, and lentils.

The country which lies to the south of the three last-mentioned regions, and which contains the larger part of the country called by the antients Byzacium, once noted for its fertility, is at present almost a desert. It must however be admitted that we know nothing of the interior, and we are very imperfectly acquainted with its most eastern and most western districts. Along the sea-shore extends a plain, whose surface is varied only by some swelling grounds and a few low hills. A few mountain-summits occasionally appear rising far to the west. Along the sea-shore the soil consists of sand, but farther inland it is composed of more compact materials. The whole however is without cultivation, but it supplies pasture to some tribes of Arabs, who have large herds of camels, horses, cattle, and sheep. In one or two places on the sea-coast indigo is cultivated to a small extent. The whole plain is destitute of trees, and even bushes are rare. The western districts, or those contiguous to the boundary-line of Algiers, consist of a long valley, which extends nearly 100 miles, from 35° N. lat. to some distance south of 34° N. lat. Its soil is dry, and only a few small rivers are met with, the waters of which are soon exhausted by irrigation. They are the only spots in the valley which are cultivated. The ridges which enclose the valley are destitute of trees and nearly without vegetation. Towards the northern extremity of the valley water is more abundant, and there are large tracts of pasture-ground for the wandering tribes.

The southern portion of Tunis is called the Jerid, or Beled-al-Jerid (the country of palm-trees). It extends from about 34° N. lat. southward to the parallel of the southern extremity of the great salt lake Al Sibhah, and on the south is contiguous to the Sahara. This lake is 7 miles long from south-west to north-east, and about 3 miles wide on an average. In summer it is dry, with the exception of the southern part, where there is always a considerable sheet of water. When dry, the central part, for 15 or 18 miles, is covered with a layer of salt, which is not so strong as sea-salt, and not adapted for preserving provisions; but it has an agreeable flavour. Between the layer of salt and the banks of the lake is a tract whose surface is sandy, or partially overgrown with bushes. In winter the whole surface is covered with water to a depth of two or three feet. It may however be passed even in this season along a track which is marked by stones, trunks of trees, skulls of animals, and sticks. The country which extends from the eastern shores of the salt lake to the Gulf of Gabs consists of a succession of hills. It contains a great number of springs and small watercourses, to which circumstance its fertility is owing: the water is employed in irrigating the adjacent fields until it is exhausted. It is particularly employed in irrigating the plantations of date-trees, which in some places cover several square miles. In other parts the country is studded with numerous little oases of palm-trees, each of them surrounding a village; but between these cultivated spots there are large tracts that exhibit no sign of vegetation. In this tract considerable quantities of henna are cultivated. Great care is taken in cultivating these grounds, and manure is applied to them. Some of the gardens are extensive, and contain a great variety of fruit-trees, as the peach, apricot, vine, almond, orange, lotus, pomegranate, and fig. Melons and onions are grown in considerable quantities. On the west of the Sibhah occurs a similar tract, which extends from the southern extremity of the salt lake to its middle, and is of superior quality: the dates which are collected in these plantations are of an exquisite flavour, and considered superior to any in Barbary. The inhabitants of this tract are wealthy, and live in well-constructed houses of stone.

Near the boundary-line of Tripoli is the Island of Gerba, which is separated from the mainland by a small gulf and two straits. The narrowest of the straits is less than half a mile across. The island is about 18 miles long, and on an average half as wide. It is not much elevated above the sea-level, and is surrounded by shallow water: the surface is level. The fertility is very great, and it is so well cultivated that it resembles a large orchard. With the exception of two small towns inhabited by Jews, there is no place which deserves to be called a village: but the whole surface of the island is dotted with villas and single houses, which are surrounded by fine orchards. Every spot on the island is cultivated: the produce is wheat and barley. Among the fruit-trees the lotus is most frequent, but dates, palms, and olive-trees are also abundant, and also the vine and orange-tree. The climate is much more temperate than that of the adjacent mainland. There are four ports, or rather landing-places—Ajeem on the west, Ierjees on the east, Marsa-es-Sook on the north, and Marsa-el-terah on the south. The population is estimated by Ewald at 150,000 individuals. The same author states that there are 400 mosques in the island. Many of the inhabitants are engaged in manufactures.

(Shaw's *Travels and Observations on Barbary and the Levant;* Temple's *Excursions in the Mediterranean;* and Ewald's *Reise von Tunis nach Tripolis.*)

Climate.—The atmosphere of the Regency of Tunis is generally pure and wholesome. The plague is not endemic or periodical, as in Egypt, and is only known when introduced from other parts. In all other respects the climate and seasons resemble those of Tripoli. The summer heats are moderated by sea-breezes along the coast, and the winters resemble our spring. Although the habits of the people are far from cleanly, and noisome insects and vermin are plentiful, and although their habitations, moveable as well as fixed, are seldom free from offensive smells, yet fevers are not frequent, and epidemic maladies are scarcely known. During the summer and autumn rain is very rare: it usually falls in November, and continues at intervals until the month of April. According to meteorological observations carried on for more than three years, the mean temperature at the town of Tunis was found to be as follows:—

Jan.	42·9°	April	64·6°	July	85·1°	Oct.	71·1°
Febr.	55·9	May	71·2	Aug.	86·5	Nov.	62·8
March	59·0	June	77·4	Sept.	80·2	Dec.	58·3
Winter	55·9	Spring	71·0	Summer	83·9	Autumn	64·0

The mean annual temperature is 69·2°.

Government.—The ruler of the territory of Tunis at present bears the title of Bey, and in state documents he is called the basha bey of Tunis, because he is invested with the rank of pasha (which, in the dialect of Barbary, is basha) by the grand sultan, to whom he sends tribute as often as his political circumstances require the sultan's favour or protection. But the Porte has little control over him, and he is an independent prince, and the sovereign of the country, with whom the states of Europe enter into treaties on matters international and commercial, and to whom they send their consuls, who are also diplomatic agents. Although he is nominally elected by a divan, yet (the members of this body being chosen by himself) he easily obtains their suffrages for the nomination of his successor in the person of one of his own family; and thus the sovereignty has remained in the same dynasty for nearly a century. By a like management his power is despotic; for the divan is only formally assembled to confirm the will of its master. This kingdom is not divided, like Tripoli, into provinces governed by separate chiefs, but is under the direct control of the bey himself, whose power is consequently the more consolidated, and no one ever thinks of opposing it. As his revenue depends greatly upon the tribute which he exacts from the Arab tribes in the interior, he is obliged to keep up a standing force, which he annually sends to scour the country and extort payment. The troops in regular pay may amount to about 8000, who were raised in 1831, and taught European tactics under French officers. The body-guard consists of 200 Mameluks, all renegades, chiefly Italians; but they, as well as the regulars, now wear the reformed Turkish uniform. The contingents furnished by the Arab tribes, amounting to 40,000 men, chiefly cavalry, receive no pay, but are exempt from tribute; and they are only called out when occasion requires them to be in the field for the defence of the country, or to overawe and assist in exacting the tribute from the rest of the population. This is done in the most arbitrary manner, according to the avidity of the officer charged with the business, who is generally a relation of the bey. The collector goes into a field, whilst the crop is still green, and values it according to his caprice. The owner is then obliged to pay a tithe on this supposed value of his future crop, although when the harvest arrives he may find that it perhaps does not exceed the fourth part of the sum at which it was estimated. The same is the case with olives and dates, in which consist the principal resources of the country. All sorts of animals, including horses, are also similarly taxed at pleasure. Those who have the art to conceal their herds and flocks are made to pay in money, which is often extorted by the bastinado; and many submit to this rather than incur the danger of declaring their means. The bey draws other revenues from the customs, from the sale of *teskaras* (permits to export grain and other produce, and for the importation of wine and spirits), from monopolies of various sorts, from a tax on the Jews, and from his own lands. He has also some sources of revenue of a casual nature, such as the wealth of his rich subjects who die, his profits in trade, which are considerable, and his extortions from those who have money whenever a public pretext furnishes him with an excuse to draw upon their hoards. It is impossible to form any estimate of the amount of this revenue. Formerly the beys of Tunis amassed wealth, but of late years it is believed that the expenditure of the state has been equal to the revenue; for besides the cessation of the profits of piracy, and the expense of the number of troops maintained by reason of the vicinage of the large French force established in Algiers, the bey has been obliged to ward off by large presents the fate which lately fell upon the hereditary basha of Tripoli when he was superseded by a governor appointed from Constantinople. These altered circumstances have entirely changed the aspect of Tunis as a naval power. As long as she was allowed to plunder upon the seas, no state was ever more active in fitting out cruisers, and no people more undaunted than the Tunesines in filling up their losses. But their once powerful navy is reduced to insignificance since 1816, as well by gales on their own shores as by the total loss of the bey's contingent in the battle of Navarino (1827). At present (1842) his force consists of two corvettes, three brigs, three schooners, and a few gun-boats, for which he has no real use, unless for trading purposes, or transmitting presents and compliments to Constantinople. The bey is the chief of the religion of the state in Tunis, and is himself the first judge in his kingdom. He sits in the hall of justice almost daily, and his decisions, which are summary, are immediately put into execution. The kaïds administer justice in the same manner in the interior towns. The kadis judge only in matters of religion.

Commerce.—The foreign commerce of Tunis is the most considerable of all the Barbary states. It is not confined to the capital, but is also carried on briskly from the ports of the eastern coast. Among the manufactured articles of export are—soap, marocco leather, Gerba shawls, and the red scull-caps worn so generally by the people of Barbary, as well as by all those of the Levant, Turks, Christians, and Jews, who shave their heads according to the custom of the East. Wheat and barley (when permitted), as well as the inferior grains, olive-oil of an excellent quality, common wool, hides, bees'-wax, dates, almonds, sponges, and orchilla-seed, are the principal articles of produce exported: those received from the interior of Africa, and afterwards exported, are—ivory, gold-dust, ostrich-feathers, senna, and madder-roots. The imports are woollen cloths, cotton-prints, calicoes, muslins, coarse linens, damasks, raw and wrought silks, fine wool, gold and silver tissues, coffee, sugar, spices, alum, vitriol, cochineal, vermilion, gum-lac, iron, tin, lead, hardware, cutlery, arms of all sorts, earthenware, glass beads, paper, wine, spirits, and tobacco. Formerly the European trade was entirely with France, Italy, and Trieste, the English manufactures finding their way through the free port of Leghorn; but now, although the English have no direct trade with Tunis, an increasing one is carried on through Malta. English merchandise, as well as that of those nations which have recently made treaties with Tunis, pays a duty of 3 per cent. upon entrance; but the Jews and others of the country pay a duty of from 5 to 10 per cent. Ammunition and naval stores are admitted free for the service of the government, although gunpowder has lately become a contraband article for the people, the Bey having now a manufactory of his own, which is one of his monopolies. As ports of loading, those of Sfax and Susa are preferred to Tunis, in consequence of the distance and delay of transporting merchandise in lighters across the lake to the Goletta, where ships generally lie; the commerce of the country is consequently best carried on in vessels under 150 tons burden. The following enumeration, from Sir Grenville Temple's work, of vessels arrived at the port of Tunis (exclusive of the small coasting vessels of the country), in all the year 1832, will not therefore give an idea of more than half of the commerce of the regency; but it will serve to indicate the countries with which it is carried on, namely, Sardinian 153, French 98, Neapolitan and Sicilian 48, Tuscan 22, English (mostly Maltese) 21, Austrian 15, Spanish 10, Ottoman 9, Tunesine 6, Greek 6, Tripoline 5, Ionian 1, and Russian 1. The trade with Central Africa passes through Gadamis. [TRIPOLI.] The caravans arrive at Tozer, Cabes, and Sfax about twice in the year, and barter their merchandise, which is thence introduced in various directions into Tunis. Besides the articles already mentioned, they bring black slaves, and they take in return dates, woollen-cloths, muslins, silks, colonial produce, skull-caps, arms, and such like. Formerly the caravans from Constantina to the capital were very frequent, sometimes arriving monthly, and they often brought with them Spanish dollars to a large amount, for the purchase of European goods, which gave a great impulse to commerce. But about the beginning of the present century the Algerines found means to divert this trade to their own shores; and now the French have effectually possessed themselves of it, to the great disappointment of the merchants of Tunis.

Towns.—The territory of Tunis contains a great number of antient towns, whose ruins lie scattered over the whole country, and now stand in the midst of these vast solitudes, some of them totally uninhabited, except by the lion, the wolf, and other ferocious animals, unless when the Arabs occasionally pitch their tents on their sites.

The next city in rank and importance after Tunis is Cairoan, or Kairwan, which was the principal station of the first Arabian conquerors. It was founded by the Arabs about A.D. 669, and was afterwards the seat of learning and of power. It is situated to the south of the capital, distant from it about 70 miles, and about 24 west of Susa. The town is large and has good houses, and is surrounded by a crenelated wall with four gates. The great mosque, which is esteemed the most sacred, as well as the most magnificent in all Barbary, is supported by many marble or granite pillars, said to amount to 500; but no Christian has ever been allowed to see them. Indeed Cairoan is the holy city of Africa, and strangers are obliged to pass through it in deep silence, without venturing to be inquisitive. Its Kaïd is almost independent of the Bey, his will being absolute in his own district; and he commands no less than 30,000 Arabs, besides governing the 50,000 inhabitants which the town is supposed to contain. The inhabitants are famed for the beauty of their yellow marocco boots and slippers, made of a leather which has never been successfully imitated.

Kaff is the third city in riches and strength, and is the key of Tunis on the western frontier. Its walls are kept in good repair, and the fortress mounts 132 pieces of cannon. There was always a small garrison here, which has lately been increased to about 1000 men. Standing in a fertile country, on the declivity of a rocky range of mountains, the view from it is very fine, embracing a great extent of land, diversified with rich plains and bold scenery. The town is not populous, but the kaïd commands a district containing 50,000 males, and is consequently a man of great power and influence, both as regards the government and the people.

This district is the country called the Beled-el-Jerid, upon the borders of the Sahara, or Great Desert, across which the people of Tozer, the great mart for dates in these parts, carry on an active traffic with the interior, as far as the Joliba, exchanging their dried fruit for black slaves, which are sold in the towns of the regency.

The towns and villages are more numerous and the population is greater in the northern parts of the regency near the capital. The Dackhul, besides being an agricultural district, abounds in game, is the seat of a large fishery, and has several small rivers running into the sea, which fertilise the country. Proceeding in this direction from the capital, we first arrive at the considerable village of Rhades, and then at Solyman, which has a large population, the descendants of Moors who fled from Spain. At Hamman Leuf, where the Bey has a palace, and at Hamman Ghorbus, are mineral-baths famous for curing rheumatic, cutaneous, and syphilitic disorders. Beyond these is Lowhareah, where there are extensive marble-quarries, which are said to have furnished the materials for the building of Carthage and Utica. Zowan, or Zagwan, a flourishing town built upon the skirts of a very high mountain of the same name, about thirty miles south of the city of Tunis, supplied water to the city of Carthage by an aqueduct fifty-two miles long, some parts of which are still standing. The stream is now employed in dyeing the woollen scarlet caps worn throughout Turkey and the Levant; and this mountain, as well as that of Kaff, furnishes ice for the Bey's use in summer. Carthage has no modern population, although only twelve miles distant from Tunis; and on the site of Utica there are only a few miserable huts, known by the name of Booshater, standing almost in a marsh. The banks of the Majerdah are covered with the sites of antient places. But in the actual condition of Tunis, it is not surprising that the lands remain almost uncultivated, the husbandman being always apprehensive that his crop may be seized, either by his own chief or by some other tribe; and indeed the government sets the first bad example, for wealth, or even the appearance of it, subjects an individual to oppression and spoliation.

The lion, the panther, the ounce, the lynx, the wolf, and the wild boar, are the principal ferocious animals that inhabit the western parts of Tunis; for to the eastward of the meridian of Tabarca the forests cease, and the country is less woody. Flies, noxious vermin, mosquitoes, gnats, ants, and the scorpion are the torment of Europeans in all parts of the country.

Inhabitants.—The Tunisines in general, like the Algerines, are a mixed race of Turks, Moors, and Jews, in the towns, interspersed with a few Christians and renegades, while the people of the country are Arabs and Kabyles of different tribes. [ALGIERS.] The Moors of Northern Africa are a white race, and it is a vulgar error to imagine that a Moor must necessarily be a negro or a person of colour. Whether from a mixture with the Spaniards during their abode in Spain, or with the Turks, who were afterwards their masters, or from the blood of renegades and female slaves taken during three centuries of warfare with European nations, they are in Tunis a comely people, and many of their women would be reckoned handsome in any part of the world. Although the people of this country are more civilized than those of the other nations of Barbary, it being the principal seat of refuge to which the Moors fled who were driven out of Spain, some of whose manufactures have thriven amongst them, yet they are very ignorant: their most instructed men have only a knowledge of reading and writing and arithmetic, just enough to manage their commercial affairs, in which they evince great acuteness, if not the enterprise of Europeans. Nor do they seem desirous of extending their learning beyond an acquaintance with the Koran; their natural apathy and indolence disincline them to other studies, and to those sciences which were cultivated by their ancestors of Cairoan and Cordova. This accounts for the employment of foreigners by the Beys as their ministers, as is now and usually has been the case. The language of the Moors is the same as that of the Arabs of Africa, the dialect becoming less pure according to their more distant situation from Egypt; but a bastard Italian, called the *Lingua Franca*, is spoken in the ports. They are strict Mohammedans, and submit calmly to the reverses of fortune. But they are avaricious, very jealous, and many of them abandoned to extreme licentiousness. Their principal amusement is smoking, or playing at chess or draughts. The females are excluded from society, and are shut up in almost constant confinement, and when permitted to go out they are closely veiled with a thick garment. They pass their time in making sweetmeats and in the care of their children; they use every method to become fat, which is considered a point of beauty, but they are not deficient in grace; they are fond of dress, which is often splendid and sometimes tasteful. The houses of the rich Moors, although of ordinary appearance without, are handsomely decorated within; their furniture consists of few articles, such as carpets, mattresses, and cushions, which are often made of rich silks and embroidery. The Beduin Arabs, who are the inhabitants of the level country, and are perpetually wandering from place to place, pitch their tents in circles called dowars, according to the season, wherever they find a desirable spot either for shelter or the cultivation of the land. The Kabyles live in the mountains, and form little villages of hovels made of hurdles and mud, or of clay and stones hardened by the heat of the sun. Both races are simple and abstemious in their living, subsisting on bread, milk, and dates. The women are industrious, and make a great part of the cloth for their own and the men's clothing, as well as the hair-covering for their tents, and employ themselves even in the laborious work of the field. The men lead an indolent life when not employed in the chase, the rearing of cattle, or in some sort of urgent labour, such as the getting in of their crops, from which no superiority of station exempts them. They have few wants, and have consequently a strong feeling of independence. Thousands have no other garment than a red cap, and a blanket thrown round the body in several turns, which serves as a covering by day and a bed by night. The farther we advance into the interior, the more these people are found as described by Leo Africanus, namely, rude and unkind to strangers. Travelling is attended with great risk, not only from probable violence, but from a scarcity of food, for it is only by working upon their fears that they can be induced to supply a traveller's wants. Any attempt to manage them by mild means would be vain. In this respect there is a notable difference between these people and the Arabs of Tripoli, who have been found hospitable according to the accounts of all travellers. But in Tunis it is only the show of authority that can insure their compliance. The idea of the Bey's power is so rooted among them by the annual excursion of his troops through the country, that his firman or mandate and the appearance of a few soldiers never meet with a direct opposition. As to that part of the country situated on the frontiers of Algiers, the Kabyles and Arabs who live there acknowledge no obedience to either government; and when they have committed a crime, they have only to pass from one country to the other to place themselves in safety. Since the possession of Algiers by the French, the people in these parts are very jealous and suspicious of all Christians, who, they think, form only one nation. The use of arms is universal: the traveller, the shepherd, the labourer, the camel-driver, the rich and the poor, are all prepared with dagger, gun, or pistol, to repel attacks, and sometimes to make them. Turks from Constantinople and the Morea, Moors and Negroes, Beduin Arabs and Kabyles, Jews and renegade Christians—all form one great body, in which each seeks his own advantage and no one thinks of a more civilized state. This people in fact has made no advancement for a thousand years, although their country lies within two days' sail of the continent of Europe. The total eradication of Christianity may in some degree account for this. The number of churches which formerly existed in Barbary is almost incredible. In the 'Notitia Episcopatuum Ecclesiæ Africanæ,' we find the names of 132 episcopal sees, in the proconsular province alone. Never however was a religion and its symbol so completely eradicated from any country as that of the cross from Barbary. Egypt in its Coptic population, and Turkey in its Armenian, Greek, and Maronite subjects, still preserve remnants of it, but Barbary has none.

The number of inhabitants of the state of Tunis is supposed to amount to about two millions and a half; amongst whom there may be 7000 Turks, about 9000 Christians (principally Roman Catholics and Greeks), and perhaps 100,000 Jews; but previous to the plague which raged in 1785, the population was estimated at five millions. In its former prosperity this country must have contained double this number, if we may judge from the numerous sites of towns of antient times and of the middle ages which are now uninhabited.

Produce.—All sorts of grain, except oats, are grown, as well as maize, beans, garbanzos, lentils, the cicer or chick-pea, and the like. One bushel of wheat or barley usually yields ten or twelve, and in some districts as much as twenty. The sugar-cane is easily reared, but the people have not learned to extract the sugar. Tobacco, coffee, and cotton flourish, and might be turned to profitable account, yet they are imported in large quantities. Olive-oil is the great staple produce, and is of excellent quality. All the vegetables of Europe are easily raised, although the potato is scarcely yet introduced. The artichoke and the gourd, or calabash, are the common food of the people; and the coriander and tomata are grown in great quantities, and serve as a necessary relish in Moorish cookery. Among fruits the first is the produce of the palm or date-tree, which propagates itself; for as the old tree dies, there are never wanting shoots to succeed it. In the Jerid particularly it flourishes, owing to the great and equal heat; and this date consequently is the finest in all Barbary, and is the principal food of the Arabs of the Sahara and the Atlas. With the exception of the hazel-nut, the filbert, the strawberry, the raspberry, and the currant, the Tunesines have all our fruits, besides those of warm climates, such as the orange, the lemon, the pomegranate, the jujube, the prickly-pear, the fig, the melon, and the grape. Amongst all these the water-melon is the only one of superior quality, a circumstance which is attributable to the bad system of horticulture. The oleander and the geranium, roses, bulbs of various sorts, pinks, and a number of aromatic herbs and rare plants, which render the Tunesines renowned for distilled waters and honey, spring forth luxuriantly, sometimes among fruit-trees and fields of cauliflowers and cabbages. Game is plentiful, as well as all sorts of poultry and eggs; but the grazing of horned cattle is not so perseveringly followed up as to furnish always an article of export, as in Tripoli. Wool is produced in great quantities. The breed of horses, formerly so celebrated, is now entirely neglected. [Barb.] An extensive fishery of the Scomber Thynnus, or tunny, is carried on by Sicilians off Capes Farina, Monastir, and Bon. The Genoese, Neapolitans, and sometimes the French, fish for coral on the northern coast near Tabarca. It is asserted that the mountains near the capital contain ores of silver, copper, and lead; but these sources of wealth are not turned to any account.

Antiquities.—Some idea may be formed of the number of antient remains existing in this country from the fact that Bruce boasts of having found in his journeys eight triumphal arches, seven Corinthian temples, and one of the Composite order, all in good preservation, besides numberless other ruins; and of having copied about one thousand inscriptions. But the most recent authority on these subjects is the interesting work of Sir Grenville Temple, upon which we must chiefly rely for our short sketch of the archæology of Tunis. There are no vestiges of antiquity in the capital, although, as in most of the towns of the regency, columns and capitals may be found in some of its buildings. The antient sites on the banks of the Majerdah abound in ruins, particularly at Dukhah (the antient Thugga), consisting of temples, an arch, a number of cisterns, baths, barracks, gates, theatres, an aqueduct, and many inscriptions. At Ayedrah is a handsome triumphal arch dedicated to the emperor Septimius Severus, and columns of various beautiful marbles. The walls of the town retain their original height in some places, and have three gates; yet antiquaries have not been able to assign to the place its antient name. At Kaff (Sicca), which, like Ayedrah, is on the western frontier, is still to be seen a paved street like those of Pompeii, and here likewise capitals, columns, and friezes are numerous. But the most stupendous monument of antient times is on the site of Tysdrus, now called El Jem, a village situated midway between Susa and Sfax, and about 20 miles from the eastern coast. Here rises in its pristine majesty an amphitheatre, which Shaw refers to the reign of the Gordians. This is one of the most perfect, vast, and beautiful remains of former times that is known to exist. Its extreme length measures 429 feet and its breadth 368; and it is only surpassed in magnitude by those of Rome and Verona. Of the fourth or uppermost story little remains, and one of the entrances from top to bottom was destroyed about one hundred years ago by the bey of that time, to prevent its being made a stronghold by some rebellious Arabs. With these exceptions it is in a complete state of preservation, with its seats, arenas, and vomitories, and retains almost the freshness of a modern erection. Coins and gems are found in these parts, which are bought up by the Jews of Sfax, and sent to Tunis for sale. In the ruins of Sufetula, now called Sbeitla, about 120 miles south of Tunis, curiosity (says Gibbon) may still admire the magnificence of the Romans; and truly it is the most remarkable place in Barbary for the extent no less than the magnificence of its ruins. It stands in a large plain totally abandoned by man. The principal ruins consist of three contiguous temples, whose ornaments are very rich and of excellent execution, two triumphal arches, another temple, and an aqueduct which spans the clear stream on which the town stood. Kazareen (the antient Colonia Scillitana), distant only a few leagues from Sbeitla, has also the remains of an arch and other ruins of minor interest. The great aqueduct which conveyed the water from the mountain of Zagwan to

Carthage, 52 miles in length, may yet be traced by masses of stone and cement, which lie, like the vertebræ of a huge winding serpent, along the whole of this distance; and in its preserved portions it is still a mighty construction, rising in some places to 98 feet. The extensive cisterns into which this aqueduct discharged itself were until very lately almost the only remains of antiquity to be seen on the site of antient Carthage: but in the year 1837 a society was formed in Paris for exploring these remains; and two of its members (Sir Grenville Temple and Captain Falbe, the Danish consul at Tunis) were charged with these operations. Their labours were well rewarded by the very interesting discoveries they made. Among them may be noticed the finding of many hundred coins, and various objects of glass and earthenware on the site of the temple of Juno. But the most remarkable discovery was that of a villa near the sea-shore, buried fifteen feet underground. Eight rooms were completely cleared, and their size and decorations prove that the house belonged to a wealthy person. The walls were painted and the floors were beautifully paved in mosaic in the same manner as those of Pompeii and Herculaneum, representing deities, dancing figures, animals, birds, plants, and fish. In another house, still more beautiful, mosaics were found, representing gladiators contending with wild beasts, horse-races, and men breaking-in young horses. Many of these were removed to Paris; and an account with coloured drawings of some of them was published in 1838, under the title of 'Excursions dans l'Afrique Septentrionale, par les Délégués de la Société établie à Paris pour l'Exploration de Carthage.' These expensive excavations however were soon discontinued; not from any discouragement on the part of the government or people of Tunis, but for want of energy or funds on the part of the French society.

History.—The town of Tunis, once known by the name of Tunes or Tuneta, is of great antiquity. But whether it was founded by a Phœnician colony or by the native Africans seems to be an undecided point. It was taken and retaken several times during the Punic Wars. In A.D. 439 it fell into the hands of the Vandals; but in 533 was rescued from them by Belisarius. It continued to be subject to the Greek emperors until the irresistible arms of the caliphs overran Northern Africa, towards the end of the seventh century, when the conqueror Okbah, or Akbah, with a view to secure the country for them, founded the city of Cairoan, or Kairwan, as a place of refuge against the accidents of war. It was here that the Arabians began to consolidate their power in Africa. From this time they became so thoroughly intermixed with the natives, that Christianity was extinguished, and the Africans have remained a Moslem people to the present day. The caliphs however, from the immense distance of their conquests from Bagdad, the seat of government, were obliged to connive at acts of rebellion which they could not repress; and thus arose in the course of time the several kingdoms into which Barbary was afterwards divided, of which Fez, Marocco, Tunis, and Algiers were the most considerable. The Arabian viceroys, at first under the name of Amer, were in fact caliphs of Africa, and established an independent government at Cairoan, which became the capital of the country which now constitutes the regency of Tunis. Here the Aglabite dynasty took its rise in the ninth century; and from this city directed its conquests, and even attacked Rome herself. The Aglabites were succeeded by the Zeirides; and these were in their turn obliged to yield to the Almoravides, who established themselves in Marocco, which city was built A.D. 1070, and its princes soon extended their power over all the provinces of Barbary, including Tunis. But in 1206, Abu-Ferez, who held the delegated government of Tunis, assumed an independent authority, and from him sprung the race denominated Lassis, who are considered the first kings of Tunis, being the first who established a court in the town of Tunis. Their dominion soon spread itself over Constantina, Bona, and Tripoli; and their vessels infested the Mediterranean, and intercepted the succours [illegible] to the Christians in the Holy Land. Louis IX. of France undertook, in 1270, his chivalric expedition against this new power, which ended in his own death, and the destruction of his troops by disease among the ruins of Carthage. Muley-Hassem was the last of these kings. He was deprived by stratagem of his throne in 1531, by the pirate Khairadeen, commonly called Barbarossa II., who had been lately acknowledged as chief of Algiers by the Turkish sultan. Having implored the assistance of the emperor Charles V., Muley-Hassem was restored to his throne as a tributary prince by Charles V. in 1535. But the Spanish dominion was of short duration; for in 157[illegible] the Sultan Selim sent an expedition of 40,000 men from Constantinople, under the command of Sinau Pasha; who made himself master of Tunis, and thus annihilated the race of kings, who had reigned over the country for 3[illegible] years, by declaring it a dependency of the Ottoman Porte.

Already in possession of the territories of Algiers and Tripoli, the conquest of Tunis completed the sultan's power throughout the Mediterranean coast of Barbary, which seems to have been desired as a check to the Christian knights who had lately seated themselves in the island of Malta in professed hostility to the Turks, and whence Selim's predecessor had in vain attempted to dislodge them. Although Algiers was the most powerful in ships and men, Tunis was the most formidable on account of her numerous havens. It was here in fact that Aroodge, the first Barbarossa, organised his maritime expeditions before he got possession of Algiers; and even after Algiers was established as the first piratical power, the Algerines moored and refitted their vessels in the ports and roadsteads of Tunis. Her northern and eastern sea-fronts offered a convenient refuge to the corsairs of all these states, whence they sallied forth in every direction, plundering the ships of Christian nations, and making slaves of their crews. This horrid warfare was at one time carried on so successfully, that a Genoese renegade who commanded the galleys of Biserta is said to have reduced no less than 20,000 persons to slavery. All this took place while the Turkish flag waved over the castles and ships of these countries; yet the Turkish sultan never held a firm power over them, insomuch that historians continued to speak of them as kingdoms, and in diplomacy they were deemed viceroyalties or regencies, whose rulers were so far independent, that they were treated with by other powers without regard to the sovereign state. How this happened at Tunis we shall proceed to explain.

Upon its conquest by the Turks, Tunis was governed by a Turkish basha and a divan, or council of military men, with a body of janissaries sent from Constantinople; but their rapacity soon disgusted the Moors, and they obtained permission to elect a dey from amongst themselves, as at Algiers. Of twenty-three deys who reigned, all were strangled or otherwise assassinated, with the exception of five. During these tumultuous times, the beys, who were the second officers of the state, gained the influence, and eventually the succession, while the divan dwindled into a mere shadow of power; and the Algerines sometimes interposed one bey in opposition to another, and planted their banners on the walls of Tunis. Yet the Porte still continued its show of authority by nominating a basha to represent it, but he had no power. In process of time the two dignities became united in one person, each new bey seeing the policy and finding the means to ensure to himself by large presents the appointment of basha, which in fact being conferred by the head of the Mohammedan religion, operated powerfully to confirm his authority. Their rule now became so absolute, that the bey generally dictated to the divan his successor, and the sovereignty descended to that son or other dependant whose hopes were most favoured by the reigning prince.

The Tunesine corsairs continued their excursions at sea until 1655, when Admiral Blake, with a powerful English squadron, the first that had been seen in the Mediterranean since the time of the Crusades, having forced the dey of Algiers to a peace, presented himself before Tunis, and without listening to subterfuges, destroyed the castles of Porto Farina and the Goletta with his artillery, and compelled the bey to promise that his piratical subjects should not commit further depredations on the English. France and Holland soon followed the same course. These promises were afterwards often renewed, but were never faithfully observed. At length, in 1816, in consequence of an agreement between the European powers, Tunis renounced for ever Christian slavery, under the threat of the punishment which Lord Exmouth with a naval force inflicted upon Algiers.

Since the present family commenced in the person of

Hassan ben Ali (the grandson of a renegade Greek), who died in 1753, there have been few revolutions at Tunis. His grandson Hammoodah, the fourth of his race, came to the throne in 1782, and died in 1815. This prince was a man of great talents, and his long reign is distinguished among those of the Moorish dynasty by many acts directed to the public good. His brother Othman reigned only three months, and was put to death. Othman was succeeded by his cousin Mahmood, who died in 1825, leaving the power in the hands of his son Hussain, who died in 1835. Hussain was succeeded by his brother Mustapha, whose son Achmet, the present basha bey, is a man aged thirty-two, full of energy and intelligence, and an acute politician. Soon after his accession, in 1837, there seemed to be a disposition on the part of the Grand Sultan to resume his power by sending from Constantinople a basha to rule in Tunis, and dispossess the established family, and thus follow up the policy already adopted in Tripoli. But the remonstrances of England and France, both unwilling to see any further change in the governments of the Barbary states, supported by a remittance of specie, said to amount to 80,000 dollars, from the new bey, induced the Ottoman government to lay aside its intention; and Achmet received the investiture of basha, like his ancestors.

The kingdom of Tunis, placed between Algiers and Tripoli, cannot but attract the attention of the politician. From Tripoli it has nothing to fear, torn as this state is by intestine divisions. But history shows that the Algerines have often been the principal movers of the revolutions of Tunis, and have sometimes invaded the country. The weakness of the Algerines has therefore always been a political wish of the Tunesines. But the taking of Algiers by the French, in 1830, did not at first seem to promise them greater security, and the bey began to organise that regular land force which we have mentioned. It appears however that the European powers have an understanding on the present political position of Tunis, which is not likely to be disturbed. No doubt the establishment of the French at Algiers will materially influence the condition of these countries. By maintaining a good understanding with England and France, and by cultivating commercial pursuits, for which her soil, her harbours, and her geographical position so eminently fit her, Tunis may become an instrument in the civilization of Barbary.

(Knolles, *Generall Historie of the Turkes;* Père P. Dan, *Histoire des Royaumes et des Villes d'Alger et de Tunis;* Boyer de Prébandier, *Histoire des Etats Barbaresques;* St. Gervais, *Mémoires Historiques qui concernent le Gouvernement de l'Ancien et du Nouveau Royaume de Tunis;* Gibbon, *Decline and Fall;* Robertson, *Charles V.*, p. 365.)

TUNIS, a large and flourishing city and port, the capital of the regency of the same name, situated on the coast of Barbary, in the Mediterranean, in 36° 46′ N. lat. and 10° 6′ E. long., in a beautiful and vast plain, bounded at a distance of about 30 miles by an amphitheatre of high mountains. It stands on the western side of a lagoon of an oval shape, about 20 miles in circumference, which by a narrow outlet, called the Goletta (or little throat), defended by a castle, opens into the extensive Bay and Gulf of Tunis. The city is encircled by a high wall with six gates, around which is another wall encompassing the suburbs, having eleven gates or passes into the country, and measnring about five miles in circumference. The town contains about 12,000 houses, and from 130,000 to 200,000 inhabitants, comprising Moors, Arabs, Turks, Negroes, probably 25,000 Jews, and about 8000 Christians. Of the Christians, 5000 may be natives of Malta, who from the similarity of their climate and language find employment as labourers, and in the petty traffic of the place: the remainder are Italians, French, and Greeks. Although each house has its cistern of rain-water collected from the flat roofs, the town is well supplied also with water from a neighbouring spring, conveyed by an aqueduct, which was built when the country was subject to the emperor Charles V.; and no place enjoys by nature a greater plenty of the necessaries of life. But the streets are narrow, irregular, and filthy in the extreme, becoming after a few hours' rain a perfect marsh, and in summer still more intolerable from their dust, rubbish, and vermin, and from the effluvia of the open drains. It is therefore only a peculiar salubrity of the climate, or, according to Dr. Shaw (*Travels in Barbary*), the great quantity of mastic, myrtle, rosemary, and other aromatic shrubs with which the country abounds, and which are used in the daily heating of the ovens and baths, that prevent the prevalence of contagious diseases. There are five principal and many smaller mosques, into which no Christian is permitted to enter. The houses in general, according to the custom in Barbary, are only one story high, with a court in the centre, and usually without windows to the street. In the middle of the city is an open space of no great extent, surrounded by shops for the sale of manufactures; and this is the only place where strangers can find relief from the tiresome monotony of close and dirty streets, dark shops, and dull-looking houses. Tunis is not distinguished by magnificent edifices, unless we except one mosque built in the reign of Hammooda Bey, whose minister Yusuf brought columns and marbles from the ruins in the interior, at an immense expense, to decorate it. The Bey's town palace is also a modern building, but in the Saracenic style; and, although situated in a narrow street, is a handsome edifice, with marble courts and galleries. No expense was spared upon it, and it might have been the most magnificent palace in Barbary, if Hammooda Bey, the founder, had lived to complete it; but it remains as he left it, in consequence of a prevailing superstition against the completion of the unfinished house of a dead person. In different parts of the town are five extensive barracks, built by the same bey; but the finest building is the new barracks, erected by his successor Hussein, near the citadel, out of the fortunes of three of the richest Moors of Tunis, who for this purpose were arbitrarily taxed. It is a quadrangle of two stories, each comprising 134 rooms, and will easily accommodate 4000 men. In fact it would be deemed handsome and well adapted to its purpose even in Europe. Tunis has now its theatre, at which Italian operas are sometimes acted. In speaking of this city most writers (upon the authority of Leo Africanus perhaps) describe it as very handsome and well-built; but those who have visited it have found themselves much disappointed. All that can be said of it is, that it is the most antient and comparatively the most populous commercial and civilized town in all Barbary.

The chief manufactures of this city are linen and woollen cloths, and embroidery, for which it has been famous ever since the settlement here of the Moors from Spain, who brought these arts with them. But Tunis is more renowned for its woollen cap, which is dyed in the waters of the Zagwan, and is preferred to all others by the Oriental nations. It is said that above 50,000 persons were employed in the making of this article. At present its export is very much reduced by the competition of Europeans; but although imitations have been sent to the Levant at a cheaper price from Marseille and Leghorn, they are inferior to the Tunesine cap in colour, fineness, and strength. The bazaars and shops offer for sale the produce of domestic industry, particularly the celebrated essences of musk, rose, and jasmine, as well as spices, gold ornaments, precious stones, although in rough settings, silver articles, marocco slippers, woollen wrappers called bernooses, wearing apparel, horse accoutrements, Gerba shawls, silk kerchiefs interwoven with gold, embroidery of all kinds, straw mats, carpets, the red skull-caps already mentioned, and fire-arms, daggers, and swords. Slaves from the interior of Africa are brought to Tunis: the number is variously stated at from 300 to 800 annually. Until very lately negroes were always to be found for sale in the open slave-market; but by the command of the present basha, Bey Achmet, this practice is now discontinued. It was in 1841 that the chief of the state emancipated his own slaves; and this example will probably have a powerful influence throughout the regency. The Bey at the same time prohibited the further exportation of slaves, who before this time were sent in considerable numbers to Tripoli, the Levant, and even to Constantinople. Although individuals are still permitted to keep their slaves, it must be admitted that their condition and treatment are better here than in any other part of Africa: for slaves, if discontented, may oblige their masters to sell them; and judging from the number of free blacks among the population, emancipation must be frequent and easy. In the suburbs vegetables, fruit, butter, oil, meat, charcoal, wood, and skins are exposed to sale, as well as all sorts of cattle, horses, and poultry; on all of which duties are collected by officers of the Bey. The town presents considerable bustle. From sunrise to sunset, when the Moors retire to rest, the streets are filled with people, among whom the women make a hideous appearance, muffled up from head to foot to conceal their persons. This bustle is still more heightened by the manner in which goods are sold here by a cryer or broker, who walks before the shops, calling out the value of an article held in his hand, and inviting the passers-by to purchase it. Valuable articles are thus exposed in the most unreserved manner. It is very common to see a hawker of jewellery and gold ornaments squeezing through a crowd, and calling customers to look at the articles he carries suspended from his arms, breast, and shoulders, of the value of many thousand piastres, without any protection, unless it be in the integrity of the surrounding multitude or the fear of prompt punishment; and this seems to be in these countries a most effectual restraint upon crime. Even the punishment of death immediately follows the sentence, which is always summary.

Being more given to commerce, the government and people of Tunis are more civilized and more civil to foreigners than those of the other towns of Barbary; and this was also remarked so long back as when Dr. Shaw visited this city more than one hundred years ago. They are very tolerant in matters of religion: the Jews have their synagogues, the Greeks and Roman Catholics have several places of worship, and the French government, under whose protection this communion celebrates its rites, was permitted, in 1841, to erect with great pomp a chapel among the ruins of Carthage, on the spot where their king St. Louis died. The Maltese are the only British subjects resident here; and although of the lowest order, and in such very great numbers, they are kept in an extraordinary manner under moral restraint by the sole influence and preaching of a few Capuchin friars of their own country, who have a convent in the city, and who, being intrusted with the Catholic mission by the Propaganda of Rome, are building also a church in the town of Susa. One of the Bey's own ministers, Signor Raffo, a Genoese, is in fact a zealous Christian, and contributes largely to the splendour of the Roman Catholic ceremonies. But this toleration would soon cease if any attempt were made to tamper with the faith of the Mohammedans, which is carefully avoided. The Protestants are too few to be known as a body. At the principal Moorish college the studies are almost confined to theology and jurisprudence; the operations requiring mathematical or philosophical knowledge, as well as the profession of physic, being mostly in the hands of Europeans or Jews. The Jews manage the monetary affairs of the government, and sometimes have the jewels of the reigning family under their care: they advance large sums, for which they obtain monopolies; and their wealth, which they however conceal as much as possible, is some consolation for the ill-treatment which they often receive from the Moors, and the state of degradation in which they live among them. There are a few minor schools for boys, at which they are taught reading and writing, and to repeat passages from the Koran. The women, even of the upper classes, receive no education. Being born for the harem, where they employ themselves in embroidery and the adornment of their persons, they are scarcely ever permitted to go out of its walls; yet they do not believe there can be any condition better than their own. They are usually married at a very early age, and do not see their husband until the ceremony is over; but as it is merely a civil union, it can be dissolved without much difficulty. The old Turkish costume of the men, from the Bey downwards, is now laid aside for the unbecoming blue jacket and European trowsers, topped with the plain red cap of the country; but the splendid trappings of their horses are still preserved.

Of the defences of Tunis little need be said. The gates in its ruined walls are closed every night, and for two hours on every Friday in the middle of the day, in consequence of a prophecy, that the Christians will take possession of the city on that day of the week, and in those hours. The citadel, called the Kasbah, is of great extent, but in a ruinous condition. It is now used as a manufactory for gunpowder, and is commanded by the heights of El Khadrah and Sidi Ismael. The Bardo is a fortified palace of the Bey, situated about two miles west of the town, in an uninteresting plain. It is surrounded by a high wall and a ditch, and is flanked with towers. Being the usual residence of the court, it is fitted up with great luxury, and even grandeur, and is said to contain upwards of 4000 inhabitants, who are all employed in one way or another in the service of the Bey. The lagoon, upon the banks of which the town is built, forms the access from seaward to Tunis; but as there is not more than six or seven feet of water within it, the town can only be closely approached by boats. Even merchant-ships loading and unloading lie outside the Goletta forts, which guard the narrow entrance from the bay to the lagoon, and their cargoes are conveyed to and from the town in lighters. The Goletta castle is strongly fortified towards the sea, and defends likewise the anchorage and the artificial harbour cut in the isthmus which separates the lagoon from the bay, where there is a dock and basin, in which the ships of war are built and laid up when unemployed, and where there is now (1842) a large frigate on the stocks; but her works are suspended in consequence of the military attitude assumed by the Bey, and the undivided attention he pays to his land forces. The castle with its outworks mounts 173 pieces of cannon, which are not in the best condition. The batteries à fleur d'eau, could not resist an European armament.

The Gulf of Tunis comprehends a coast of 80 miles between Cape Farina and Cape Bon, which are 39 miles asunder; while the two inner promontories, called Cape Carthage and Cape Zaphran, approach each other within 12 miles, and form an inner bay, which is almost circular, and has from 10 to 20 fathoms depth in the centre, gradually decreasing towards the shore. The ground within this bay, which is sometimes called the Bay of Carthage, holds well, and a fleet of any magnitude may ride here beyond the range of cannon-shot, and in safety, by observing common precautions against a north-east wind, to which the anchorage is sometimes exposed in winter. The soundings in the Gulf are much deeper, being from 24 to 65 fathoms.

TUNJA. [GRANADA, NEW.]

TUNNEL, in civil engineering, an arched passage formed underground to conduct a canal or road on a lower level than the natural surface. The derivation of this word, which, in the sense above given, is unnoticed by most lexicographers, is rather uncertain. Richardson places it among the derivatives of *tun*, and defines it as 'any inclosure, inclosed way or passage;' as a chimney-tunnel, or passage for smoke, in which sense the word *tunnel* or *tonnell* is used by Spenser and other early English writers; a passage for liquor, in which sense, as well as in that last mentioned, it is convertible with *funnel*; or a net shaped like a tunnel for liquids, wide at the mouth and diminishing to a point. He also observes that 'Tooke thinks *tun* and its diminutive *tunnel* (Anglo-Saxon, *Tunne, tenel*) are the past participles of the [Anglo-Saxon] verb *tyn-an*, to enclose, to encompass.' From the same root (*tyn-an*) the word *town* seems to be derived, expressing a place enclosed, encompassed, or fenced in.

Long tunnels are usually made through hills in order to avoid the inconvenience and loss of power occasioned by conducting a canal, road, or railway over elevated ground, and also the enormous expense of such an open excavation as would be necessary in order to preserve the requisite level. Those of less extent are frequently constructed to avoid the opposition of landowners, or to afford uninterrupted passage under a road, canal, or river. Many tunnels of the latter character differ in no material point from bridges; but in the case of oblique crossings a tunnel is distinguished from an oblique or skew bridge by its faces being at right angles with the direction of the lower passage, instead of being parallel with the direction of the upper passage. Of this character are the tunnels under the Hampstead road, between Euston Square and Camden Town, and the Kensall Green tunnel, under the Harrow road, both on the line of the London and Birmingham railway; and that on the (unfinished) West London railway, passing under the Paddington canal at Wormholt Scrubbs. The Thames tunnel is the most remarkable example of tunnelling under a river, and, although far less extensive than many other tunnels, it is, from the almost insuperable difficulties of its situation, perhaps the most astonishing work of the kind ever executed. Another class of tunnels are those made under towns, in order to form a canal or railway communication with points which are inaccessible by an open passage, except at great expense. The Regent's canal, for example, passes under Islington, London, by a tunnel three-quarters of a mile long; and the Liverpool and Manchester railway is conducted from the station at

Edge-hill, on the outskirts of Liverpool, to the docks at Wapping, for goods traffic, and to Lime Street, in the centre of the town, for passenger traffic, by two tunnels, each of which is about a mile and a quarter long. A tunnel is also projected to connect the Manchester station of the Manchester and Birmingham railway with the united station of the Leeds and Liverpool lines at Hunt's Bank, which must, in consequence of its necessarily low level, be connected with the main line by a vertical drop, or some similar contrivance.

The construction of tunnels is by no means of recent origin, although it is only of late that they have become common. The outlet for the drainage of the lake Copaïs in Bœotia [Bœotia, p. 43] is one of the oldest monuments of the labour of man. The great tunnel in Samos, which was seven stadia, or 4200 Greek feet, in length, was driven through a mountain 900 feet high, for the purpose of serving as the bed of a channel to convey water from a natural source to the city of Samos. (Herod., iii. 60.) The Posilipo near Naples, which is at least as old as the beginning of the reign of Tiberius, is a tunnel three-quarters of a mile long. [Posilipo.] The tunnel which was made at an early period in the Roman republic for the partial drainage of the Alban Lake is above a mile in length. [Alba Longa.] Of antient works of this character there is a remarkable example in the subterranean canal from lake Fucinus, or the lake of Celano, to the river Siris, originally formed by the emperor Claudius, and recently cleared out by order of the Neapolitan government. [Abruzzo, vol. i., p. 41; Celano, vol. vi., p. 398.] This extensive tunnel, which is about three miles long, thirty feet high and twenty-eight wide at the entrance, and nowhere less than twenty feet high, passes in part through solid rock, and is lined in other places with masonry; and it appears to have been constructed in a manner resembling that now usually followed, the excavation having been carried on by several parties or gangs simultaneously, by means of vertical shafts, and inclined passages or galleries from the sides of the mountain. A minute account of the tunnel, as it appeared during the recent clearing-out, is given in the thirty-eighth volume of 'Blackwood's Edinburgh Magazine' (p. 657), in a paper entitled 'Eight Days in the Abruzzi.' The object of this tunnel is to carry off the superfluous waters of the lake; but in more recent times similar works have been executed for navigable canals. Some of the principal canal-tunnels in England are enumerated in the article Canal, vol. vi., p. 220. These are generally of small transverse dimensions, being calculated for the passage of single boats, and very often without towing-paths, in which case the boats are either hauled through by a rope or chain, worked by a steam-engine, or propelled by men lying on their backs on the deck, or on projecting boards provided for the purpose, and thrusting against the sides or roof of the tunnel with their feet. This dangerous practice has occasioned much loss of life, and is also objectionable on account of its tediousness, as boats are often detained for a long time at one end of the tunnel while a boat is coming from the opposite end. In the evidence before the House of Lords on the Great Western railway bill, in 1835, it was stated that great delays were experienced at the Islington tunnel when any accidental derangement prevented the steam-engine and chain from working; because, although boats were occasionally 'legged' through in as little as seventeen minutes, the ordinary time required for working a light barge through the tunnel, by two men, was half an hour, and for a loaded barge three-quarters of an hour, or frequently an hour. In such cases boats arriving in the opposite direction had to wait at the mouth of the tunnel, until, frequently, as many as half a dozen were collected, which, when their turn arrived, passed through in a train. At some of the longer tunnels this inconvenience was even greater. At the Harecastle tunnel, on the Trent and Mersey, or Grand Trunk canal, two hours were formerly required to effect a passage of little more than a mile and a half. 'This place is so frequented,' observes the Baron Dupin, in his 'Commercial Power of Great Britain,' 'that at the moment when the passage begins, a file of boats a mile long is often seen.' To prevent confusion, those going towards Liverpool were allowed to pass in the morning only, and those in the contrary direction in the evening. This tunnel, which was formed by Brindley, and was one of the earliest works of the kind executed in this country, was commenced about the year 1766. It is 2880 yards long, 12 feet wide, and 9 feet high, and is in some parts as much as 70 yards beneath the surface. It is lined with a semicircular brick arch, and was completed for the small sum of 3*l*. 10*s*. 8*d*. per yard. Increased traffic upon the canal having rendered it necessary either to construct a new tunnel or to enlarge the old one, the former alternative was adopted; and in 1822 Telford was engaged to superintend the work. The new tunnel, which runs parallel with that of Brindley, is 2926 yards long, 14 feet wide, and 16 feet high; and, notwithstanding its greater dimensions, it was executed in less than three years: the original tunnel occupied eleven years. The new tunnel has an iron towing-path, so supported as to allow the water to play freely beneath it, which gives the advantage, so far as the play of the waves is concerned, of a waterway of the full width of the tunnel. It is perfectly straight, and the light can be seen from end to end; and so agreeable is the travelling through it, that one of the bargemen said, after passing it, that he wished it extended all the way to Manchester.

Although in some cases the adoption of a tunnel on a line of railway or canal may be decided by the necessity of non-interference with property on the surface, it is more generally a question of expediency, which involves the consideration of many important points, among which the nature of the ground is one of the first. The ground should be examined by numerous borings, because sudden breaks or faults in the strata, which may occasion great difficulty and expense in tunnelling, may otherwise escape notice. The Kilsby tunnel, on the London and Birmingham railway, presents a case in point; the trial shafts having been accidentally sunk just beyond the limits of a bed of sand and gravel, so full of water as to resemble a quicksand, which occasioned so much difficulty, that the contractors had to relinquish the work, which had been let for 99,000*l*., but ultimately cost upwards of 320,000*l*., or about 133*l*. per yard. If the first small borings appear satisfactory, shafts of at least four feet diameter should be sunk along the line of the tunnel, down to its extreme depth; and the quantity of water which appears in these shafts in a given time be noted, in order to ascertain, as nearly as possible, what draining power is requisite. If the trial shafts be judiciously placed, they may subsequently be used as working shafts, which will render the expense of forming them of large diameter immaterial. When the quantity of water and the nature of the strata have been thus tested, the engineer possesses data for calculating the comparative cost of a tunnel and an open cutting, in doing which it is necessary to consider the adjoining works of the line. If embankments be required within a reasonable distance of the proposed tunnel, it may become a question whether it will be most economical to make a cutting, and to carry the excavated earth to the embankment, or to adopt a tunnel, and to obtain the required quantity of earth for the embankment from side-cutting, or in any other way. Sometimes it may be necessary to deposit the material taken out of the tunnel in spoil-banks, in which case the power of obtaining sites for them, and of making convenient temporary roads or tramways for the removal of the earth, must be considered in selecting the positions for the working shafts. These are only a few of the points to be considered in estimating the expense of a tunnel, among the less prominent of which is the probability of being called upon for damages owing to the intersection of springs, which may occasion mischief at a great distance. Cases have occurred in which the water has been drawn from wells a mile from the tunnel. This evil may often be remedied by sinking the wells to a greater depth, but in some cases it is better to offer compensation at once. The cost of the actual making of the tunnel varies very greatly, according to the nature of the ground and the amount of brickwork required. Lecount, in the interesting practical article 'Tunnel' in the seventh edition of the 'Encyclopædia Britannica,' states that many of the old canal tunnels were made for less than 4*l*. per lineal yard, and that railway tunnels of the ordinary dimensions vary from about 20*l*. per yard, in sandstone rock, which is at once easy to excavate, and able to stand without any lining of brickwork or masonry, up to from 100*l*. to 140*l*. per yard in very loose bad ground, such as a quicksand, which may require a lining of brickwork twenty-seven inches thick. The cost of the Thames Tunnel, according to the same authority, has been about 1200*l*. per yard; but in this case, in addition to the unparalleled difficulties attending the excavation, the amount of brickwork is much greater than in ordinary tunnels, and there are two arches, each of which may be considered a distinct tunnel.

Rocky strata, if the stone be of a nature to work freely, are usually the cheapest for tunnelling, owing to the absence of lining, and the power of saving labour by the use of gunpowder. In the extraordinary tunnels and rock excavations at Bishopton, on the Glasgow, Paisley, and Greenock railway, 314 tons of gunpowder were used in a length of 2300 yards in hard whinstone, some veins of which were so hard that the rate of progress at each face of the excavation varied from three feet six inches to six inches only per diem. The Box tunnel, on the Great Western railway, passes for a considerable distance through strata of Bath freestone, geologically termed the great oolite formation, and presents some features worthy of notice. Reports having been circulated, since the opening of the railway, that this tunnel was unsafe, Major-General Pasley was deputed by the Board of Trade to examine it, and from his report, dated August 12, 1842, the following particulars are derived:—The tunnel occurs on a gradient or inclination of 1 in 100, ascending from west to east, while the natural dip of the oolitic strata is about the same in the opposite direction: they are nearly horizontal in a direction from north to south, or transverse to that of the tunnel. The strata vary in thickness from 2½ to 4 feet and upwards, and are intersected by vertical fissures, of trifling width, but of considerable height; the direction of which is generally at right angles with that of the tunnel, but in some cases obliquely across it. These fissures had occasioned some alarm; but the minute examination to which they were subjected led Pasley to report that he considered the rock sufficiently solid, as it everywhere emitted a clear sharp sound when struck with a hammer or an iron rod, while, had it been dangerous, the sound would have been hollow and dull. The examination of neighbouring quarries in the same strata, in which such fissures exist in greater numbers and in more hazardous situations, confirmed his opinion of the safety of the tunnel. The eastern end of the tunnel is, for a short distance, lined with masonry; beyond which, for about half a mile, the excavation is left without any support from masonry or brickwork, its extreme width being, in this part, 30 feet, and its height varying from 30 to 40 feet, in order to avoid finishing above in any stratum of doubtful character, which, though sufficiently strong in the sides, might not be so trustworthy as a roof. The sides of the excavation are cut in the form of an oblong elliptical or nearly a Gothic arch; but the uppermost bed of oolite, which forms the roof of the tunnel, has not been completed in that form, but has, for greater strength, been left flat for a width of two or three feet; and in order to avoid the risk of exfoliation which would have attended the cutting of the edges of the strata to a thin wedge shape, had the curved line of the tunnel been continued unbroken where it intersects them in the sides of the roof, they are cut in the form of steps, each stratum presenting a thick blunt edge; so that, in the words of Pasley's report, 'the upper strata of the oolite being supported by those below them, beyond which they each successively project in a moderate degree, like corbels in architecture, the whole enter into that sort of combination which has the strength of an arch without its form; provided that the vertical fissures do not cut through them longitudinally,' of which no symptom was apparent. The remaining portion of the Box tunnel, passing in the centre through beds of fullers' earth and clay below the great oolite formation, and towards the western extremity through the inferior oolite, is arched over with brickwork, varying in thickness from four to seven concentric half-brick rings, and at the western entrance containing nine such rings. An inverted arch is introduced excepting where the oolite forms the foundation or bottom of the tunnel; and in some parts a portion of the side walls has been formed of the inferior oolite, unprotected by brickwork, although it has not in any instance been trusted for the roof. The judicious adoption of such changes in the amount of masonry forms an important part of the duty of the engineer, and is essential to the construction of tunnels at a moderate expense, although it may occasionally lead to failure, as in the case of the Summit tunnel at Littleborough, on the Manchester and Leeds railway, where, in passing through a stratum of blue shale, the invert had been discontinued for a short distance; but the shale, although apparently hard and firm, was so affected by the atmosphere as to soften and yield under the pressure of the sides, rendering it necessary subsequently to put in a strong invert of masonry.

Tunnelling in clay is frequently attended with formidable difficulties which render it very expensive. It is, when tough, a difficult material to remove, blasting being of no use, and spades and pickaxes being almost inapplicable. Lecount states that in such cases hatchets may be used to advantage, but that cross-cut saws answer best. The Primrose Hill tunnel, on the London and Birmingham railway, passing through the London Clay, is an example of the difficulties of such a material. The engineers, warned by the failure of the tunnel attempted some years before through the same material at Highgate, on what is now called the Archway road, which fell in owing to the insufficiency of the brick lining, adopted unusual precautions in the first instance, excavating only nine feet in advance of the brickwork, and supporting the clay by very strong timbering until the arching was complete. Owing however to the extraordinary mobility of the moist clay the pressure upon the brickwork was so great as to squeeze the mortar from the joints, and to bring the inner edges of the bricks in contact. The evil was augmented by the form of the bricks, which, according to the custom in and near London, were made with hollow surfaces, and were consequently unfit to bear great pressure, because their edges only could come in contact. The result was, as stated in Lecount's 'History of the Railway connecting London and Birmingham,' pp. 32, 33, that 'by degrees the bricks were grinding to dust, and the dimensions of the tunnel insensibly, but irresistibly, contracting.' This difficulty was overcome by the use of very hard bricks laid in Roman cement, which, by setting hard before the external pressure became so great as to force the bricks into actual contact, enabled the whole surface of the brick, instead of its edges only, to resist the pressure. The thickness of the brickwork was also increased, so that in most parts of the tunnel it amounts to twenty-seven inches. The occurrence of a similar material in the line of the Fareham tunnel, on the Gosport branch railway, occasioned great expense, and produced a slip of the superincumbent earth which carried away about forty yards in length of the brick arching, although it was of the unusual thickness of three feet.

Tunnels formed through chalk are often impeded by faults or cavities filled with wet gravel or sand, which pour a flood of semifluid matter into the excavation as soon as they are cut into. The irruption of such loose materials, as well as of water alone, has in many cases occasioned difficulties almost insurmountable. In the Watford tunnel, on the London and Birmingham railway, which passes through the upper chalk formation, where it is covered with a thick irregular bed of gravel, such breaks occasioned great inconvenience. The chalk had occasional fissures, sometimes as much as one hundred feet deep, filled with clean gravel, 'which,' observes Lecount (*History*, &c., p. 114), 'when worked into, rushed down with such violence, as to plough the walls of the tunnel as if bullets had been shot against it.' Such an accident, occurring at the foot of one of the working shafts, overwhelmed ten men who were at work in the tunnel, and led to the construction of the large ventilating shaft near the centre of the tunnel, which occupies the site of the cavity. Loose sand is perhaps the most difficult soil that can be met with in tunnelling, but it has been in several instances successfully passed through. In the tunnel of the Leicester and Swannington railway, one of the earliest railway tunnels, a loose dry running sand was encountered for a distance of five hundred yards, in which it was necessary to make a wooden tunnel to support the soil while the brickwork was executed. When water occurs with the loose soil the difficulty is still greater. This was the case in part of the Wapping tunnel at Liverpool, a portion of which fell in, to a depth of thirty feet from the surface. The Kilsby tunnel, before alluded to, is a more striking example of this kind of difficulty. Mr. Stephenson, the engineer, conquered this obstacle by sinking shafts a little beside the line of the tunnel, for pumping out the water, and so draining the sand until it was sufficiently dry for tunnelling. These shafts were sunk through the quicksand by means of wooden tubbing, and from them headings were driven to collect the water and to conduct it to the pumps. Steam-engines were erected to work the pumps, which were used incessantly for nine months before the sand was dry enough to allow the work to proceed: during a great part of that time two thousand gallons of water were removed per minute. When the working of the tunnel was recommenced, headings were driven from the pumping shafts to the bottom of the working shafts, by means of which the tunnel was freed from water. The quicksand extends over about four hundred and fifty yards of the length of the tunnel, and its bottom dips to about six feet below the arch. On occasion of an irruption of water in another part of the tunnel, in which it was desirable to complete the arching of a portion already executed, before it was possible to get rid of the water, that object was effected by floating the men and materials to the spot upon a raft. Water has been met with in large quantities in several other tunnels. It flowed so freely from fissures in the freestone rock through which the Box tunnel is driven, that in November, 1837, the steam-engine employed in pumping proved insufficient, and the water filled one division of the tunnel, and rose to the height of fifty-six feet in the shaft, thereby suspending the work until the following July, when the water was overcome by means of a second engine, of fifty-horse power. After another irruption in the same tunnel, the water was pumped out at the rate of thirty-two thousand hogsheads a day. The progress of the Merstham and several other tunnels has been stopped for a time in like manner. In no case however has the irruption of water or the badness of the ground proved so serious a difficulty as in the Thames tunnel.

Short tunnels are occasionally excavated from the ends only, but those of considerable length are usually formed by sinking vertical shafts, about nine feet in diameter, down to the level of the tunnel, and excavating in each direction from the bottom of each shaft, until the several parties of workmen meet in the intermediate portions. By this means the work can proceed at any required number of points or faces, so as to bring the execution of the tunnel, whatever may be its length, within a moderate period of time. The accurate junction of these detached workings is provided for in the following manner, of which our account is condensed from the 'Encyclopædia Britannica,' where, in addition to every practical point relating to the construction of tunnels, the necessary arrangements with contractors and landowners are detailed very minutely:—In setting out the tunnel, the engineer plants a transit-instrument in an observatory erected in the line of the tunnel, supporting it on a pier insulated from the building to prevent vibration. If a road happen to pass near the observatory, the ground should be excavated round the pier to a depth of from six to ten feet, according to the traffic, for the same purpose. A distant mark should then be selected in the line of the tunnel, and a fixed point placed as an adjusting spot for the line of direction, which point should be at a considerable distance. Intermediate marks for the working and ventilating shafts may then be set out correctly; and as these shafts are sunk, the points determined by the transit-instrument are carried downwards by carefully suspended plummets, which should be of iron, and let down in buckets of water, or, which is better, in cups of mercury, to check vibration. When the shafts are cleared out at the bottom, other transit-instruments may be placed in them, the plumb-line and transit being kept as far apart as possible. The intersection of the vertical hairs in the transit with the plumb-line will then enable the engineer properly to set out the work. By these means junctions are effected between the several workings, or *shifts*, with surprising accuracy. In a length of 1520 feet between two shafts of the Box tunnel, which has a slope of 1 in 100, the junction of the two shifts was perfect in point of level, and did not deviate more than an inch and a quarter in any place at the sides. Even in curved tunnels, although the difficulty is increased, great exactness is attainable. In those on the Glasgow and Greenock railway at Bishopton, the deviation from perfect correctness nowhere exceeded two inches.

The number of working shafts in a given length of tunnel is determined by the nature of the ground and the time allowed for excavation. They should be so near together as to allow the tunnel to be excavated and lined, if brickwork be requisite, for a length equal to one-half of the distance between two shafts, at least two months before the time appointed for the completion of the tunnel; that time being desirable to allow for accidents, for building the tunnel-fronts, ballasting and laying the railway, &c. The shafts are usually nine feet diameter in the clear, and lined with brickwork nine inches thick, laid in cement; all the bricks being laid as *headers*, or with their ends towards the centre of the shaft; but the substance of the brickwork must vary with circumstances, and engineers are by no means uniform as to the dimensions of their shafts. Those of the Box tunnel are mostly 25 feet in diameter, while some tunnels have been excavated with shafts of only three or four feet. Down to a depth of 50 or 60 feet the earth may be removed by means of a simple roller or winch worked by two men; and when the depth is greater a horse-gin may be erected to draw up the loaded skips or buckets. The depth at which the horse-gin becomes preferable is however dependent in some degree upon the nature of the strata to be excavated; because when they are hard, the men above may have to wait occasionally for the coming up of the skip; and it is better to have only two men at a stand-still instead of a horse, a horse-boy, and a banksman or skip-lander. The roll or winch is, at the commencement of the shaft, supported by four bars or cills laid across each other on the ground; and the excavation is continued until the earth exhibits signs of weakness. A wooden curb or ring about three inches thick, and as wide as the brick lining is to be, is then laid in, and upon this the brickwork is laid. When the lining of this portion of the shaft, which is frequently but half a brick, or four inches and a half in thickness, is completed, the excavation is recommenced, and is carried down in a vertical line even with the inner surface of the brickwork, which is then supported by the earth left under the curb, which may be further supported if necessary by diagonal timber props. When the excavation has been carried so much deeper that the ground again appears weak, a second curb is inserted in a groove cut in the earth, and the ground between the two curbs is divided into four, six, or eight vertical masses, of which one or two are removed to a depth equal to the thickness of the brickwork. The wall is then built up in its place, and a further portion of earth is removed, and so on until the lining is complete. When the shaft is carried down to the full depth, the miners begin to excavate laterally by forming a heading or driftway along the level of the upper part of the tunnel. Sometimes such a drift is formed throughout the whole length of the tunnel before any part is opened out to the full size; but in other cases it is made in short portions, little exceeding the lengths in which the excavation of the tunnel itself is carried on, which may vary, according to the ground, from three to fifteen feet. In the former case the driftway, which is about four feet wide and five feet high, affords a satisfactory test of the strata to be passed through, and of the probable quantity of water to be met with, for which it may in some cases serve as an adit or drain; and for these reasons such a heading is occasionally formed before letting the contracts for the tunnelling.

In addition to the working shafts, the contractor is usually allowed to sink any number of small air-shafts of three or four feet diameter, as may be necessary to prevent the accumulation of foul air in the workings of the tunnel; provided that no such shaft shall open into a public road, or be within fifty feet of a working shaft. These are formed in a similar manner to the working shafts, and both are finished at their lower ends by resting upon a cast-iron curb or ring imbedded in the masonry of the roof of the tunnel, and at the upper ends, after the works are completed, by building them about ten feet above the surface, and coping them with stone. In very long tunnels one or more large shafts are desirable for the purpose of ventilation, and also to admit light, so as in some degree to lessen their gloom. In the Kilsby tunnel, which is between a mile and a quarter and a mile and a half long, there are two such ventilating shafts, 60 feet in diameter and about 100 and 132 feet deep respectively. These were built from the top downwards, in the manner above described, in portions ten feet deep, and from six to twelve feet wide. Lecount gives the following directions for the brickwork of such a shaft, if made in unfavourable ground:—The tunnel itself at the point of intersection should be of stone. The lower part of the shaft, to the height of 46 feet, should be three feet thick; the next 17 feet, two feet eight inches thick; the next portion of the like extent, two feet three inches; and the uppermost 16 feet, one foot ten inches. The bricks should be laid in alternate courses of headers and stretchers, and each brick should be well flushed up. The top may be finished with a stone coping and an iron railing, and protected by an outer fence wall, to prevent the risk of any thing being thrown down the shaft either by accident or design. In some tunnels a large oblong excavation, called an *eye*, is introduced in lieu of a circular ventilating shaft. In the Bishopton tunnel there is such an eye 300 feet long; and there are two similar openings in the Glasgow tunnel of the Edinburgh and Glasgow railway.

After the completion of the driftway, either through the tunnel or to the length of a single stage only, the miners excavate the tunnel to its full dimensions; beginning by cutting downwards, and propping up the earth with timbers as they proceed; those which support the roof being at such an elevation as to allow the centering to be set up and the brick arching to be built beneath them. The bars which immediately support the earth, extending from the top or outside of the completed brickwork to a framework placed against the face of the excavation, are called *side-bars*, and are in favourable earth required at the upper part of the tunnel only; but in bad ground they are required sometimes as low as the springing of the inverted arch which forms the bottom of the tunnel. When a complete brick lining is required, the invert is the part first built, and it is completed by a course of stone laid along each side, at the point where the side walls spring from it. These courses of stone, which are marked *a*, *a*, *a*, *a*, in the subjoined cuts, *Figs*. 1 and 2, consist of blocks about three feet long, well bedded in mortar, upon a few courses of brickwork laid as a footing. The side walls are next raised, with such a batter or curvature as may enable them best to sustain the pressure of the external earth; and when they are raised to the level of the springing of the arch, beams of wood, called *cills*, are laid across the tunnel and built in with the brickwork. Upon these cills the trusses of the centering are set up, and adjusted with wedges to the proper height. Laggins, or pieces of wood stretching longitudinally from one centering to another, are then added, and upon these the bricks are laid. In some cases the cills are supported upon trestles, instead of being built into the walls; and where this is not the case, the holes left in the masonry must, after the removal of the cills, be carefully filled up. The excavation should always be made as nearly as possible of the size and shape of the intended masonry; and as the building proceeds, every cavity left outside the brickwork should be carefully filled up. Well pounded clay may for this purpose be rammed under the invert, and almost any other material may be used for the sides and roof. The ramming of the sides may be performed after the laying of every second course of brickwork, and that above the arch as frequently as convenient. The timbers used to support the superincumbent earth are in most cases removed as soon as the arch is completed; but in very bad ground it is sometimes necessary to leave them imbedded in the earth. When the work has proceeded so far that the excavations from the two adjoining shafts are within about fifty yards of each other, if no driftway have been previously made through the tunnel, it is advisable to drive a heading through the intervening earth, to insure a perfect junction of the two shifts.

Many of the earlier tunnels were constructed with vertical sides and a semicircular arch; but it is now more usual to have the sides curved or battered, the degree of curvature, as well as the shape of the arch which forms the roof, being varied according to the nature of the ground, as soft semi-fluid ground will press much more equally in every direction than strata of a harder and drier character, and will therefore require a nearer approach to the circular form. The annexed cuts represent two varieties of form, the details of which are taken from the first series of Brees's 'Railway Practice.' *Fig*. 1 is the form of the Primrose Hill tunnel, in moveable London Clay. The invert, which consists of three concentric half-brick rings, is a curve of 25 feet radius; the arch, of four half-brick rings,* is struck with a radius of 11 feet 9 inches; and the sides are arcs of 27 feet 6 inches radius. The width of the tunnel is 21 feet 5 inches at the springing of the invert, and 24 feet 8 inches at the widest part. The clear height of the tunnel is 21 feet 8 inches, the remaining depth of 3 feet 4 inches being occupied by the ballasting, drain, &c. The side walls are 18 inches thick, like the arch which constitutes the roof. *Fig*. 2, which represents the transverse section of the Linsdale and Kilsby tunnels, both on the Birmingham railway, has an elliptical arch, consisting of several circular arcs, of which the lower pair, extending from the invert to the point marked *b*, are struck from radii of 42 feet 8 inches, the centres being upon an horizontal line 8 feet 4 inches above the springing of the invert; the portion from *b* to *c* has radii of 21 feet, the centres being on the same horizontal line; that from *c* to *d* has radii of 14 feet 4½ inches; and the crown of the arch is a curve of 9 feet radius. In this case also the invert, instead of being struck from a centre in the crown of the arch, has its centre some feet below it. The internal height of this tunnel is, altogether, rather more than 2[illegible] feet, and its greatest width is 24 feet. These dimensions are rarely much exceeded on railways of the ordinary gauge, where two tracks are provided for; and for a single track perhaps 12 feet wide and 16 feet high may be taken as an average. Both the invert and the arch should be built in half-brick rings, care being taken to put in the proper number of bricks to each ring, that the bearing may be uniform. In tunnels of the ordinary dimensions, each ring should contain five more bricks than that immediately within it. The side walls may be built in what is called English bond, consisting of alternate courses of headers and stretchers. The bricks should always be of the best quality, and, when the form of the tunnel requires it, moulded of a taper shape. In the laying also care is requisite, and every brick should be bedded with a wooden mallet, and the joints, if in mortar, well flushed up. The thickness of the lining is regulated by the nature of the ground, but Lecourt says that 27 inches at the top and sides, and 18 in the invert, if laid in cement, will be sufficient, even in a quicksand: there are however instances of a thickness of 10 rings, or 45 inches. It is sometimes considered adviseable to lay the first or inner ring of the roof without mortar, and then to grout it, by which means an equable pressure is insured.

Fig. 1.

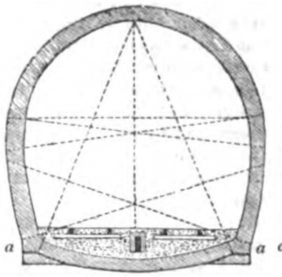
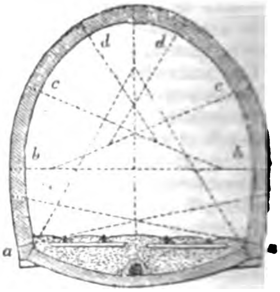


Fig. 2.



A brick drain, built in Roman cement, with the joints left open for about half an inch to admit water from the ballasting, should be laid along the centre of the tunnel; and if the shafts let in water, it should be collected and conducted down the inside of the arch by pipes. Water should be excluded as much as possible during the building of the tunnel and shafts, by puddling with clay, or such other means as the circumstances may dictate; but whatever precautions may be used, water will frequently percolate through the brickwork to a serious extent. At the Chevet tunnel, near Wakefield, this inconvenience has been remedied by lining the roof with sheet zinc. In the Thames tunnel there is an interior lining of cement, behind which channels are provided in the brickwork for the passage of water. A remarkable instance of difficulty arising from this cause occurs in the Beechwood tunnel, 302 yards long, upon the London and Birmingham railway. It passes through alternate strata of rock and marl abounding in springs; and, in the first winter after its erection, a chemical action took place, which partially destroyed many of the bricks. It was proposed to line the arch with cement; but an apprehension was entertained that it would not adhere, owing to the constant dropping, and it was determined to apply an interior lining of brickwork, nine inches thick, and to cut chases in the old work, which, when closed in by the new arch, should become so many drains, four inches and a half square, to conduct the water to the central drain or culvert. The tunnel was divided longitudinally by a temporary partition, and the work was executed in one-half of the tunnel at a time, without stopping the passage in the other half. After executing as much as possible of the brickwork in this way, a series of bearers was laid overhead supporting a close flooring, on which the men stood to complete the arch. The details of this curious operation, which was completed in forty days, in the latter end of the year 1840, were fully detailed by Mr. T. M. Smith, in a paper laid before the Institution of Civil Engineers.

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* As before stated, it was found necessary, in most parts of this tunnel, to increase the thickness of the brickwork from 18 to 27 inches.

In laying the roadway in a railway tunnel care should be taken to avoid the use of any ballasting of a character likely to retain water. The ballast is sometimes thrown down the shafts on to an inclined plane at the bottom, which conducts it in the right direction. In spreading it, it should be well beaten down with wooden rammers, and the blocks or sleepers should be bedded with great care. As it is especially desirable to avoid all risk of accident in travelling through tunnels, while their darkness might prevent the immediate detection of any derangement of the rails, some engineers, for greater security, place the sleepers or points of support closer together in tunnels than on other parts of the line. The temperature being more uniform than in the open air, renders it easy, with proper care, to provide more accurately than usual for alterations in the length of the rails by expansion and contraction.

Although, in the majority of cases occurring in railway and canal practice, tunnels are constructed in the manner just described, there are exceptions which require notice. In tunnelling near the side of a hill expense is occasionally saved by driving horizontal or nearly horizontal passages, which are called *galleries*, from the face of the hill to the line of the tunnel, and removing the excavated earth through them. The double tunnel through the Shakspere Cliff, near Dover, on the line of the South-Eastern railway, was constructed in this way. A benching or road was formed along the face of the cliff, to afford the means of access for the workmen; and the tunnel was excavated by means of seven galleries opening in the face of the cliff, and inclining towards the sea at the rate of 1 in 176. Their average length is about 400 feet; their width six feet, and their height seven feet; and the excavated chalk was conveyed along them in small tram-waggons, and tipped into the sea. There are also seven vertical shafts, of six feet diameter, and of an average depth of 180 feet. The tunnel consists of two arches or passages, 12 feet wide, separated by a wall of chalk 10 feet thick; they are about 19 feet high to the springing of the arch, which is of a pointed or gothic form, and about 30 feet high in the centre; and each will when completed have a single track or line of railway laid through it. The chalk of which the cliff is composed is very hard, but consists in many places of small detached masses, so that brick lining is required for about two-thirds of the whole length. The arching consists generally of three half-brick rings, and is strengthened at intervals of twelve feet by counter-forts, which are carried up and stepped back, so as to sustain the weight of any flat beds of chalk that appear of doubtful stability.

Another variation from the ordinary process occurs in those tunnels which are formed by means of an open cutting, and subsequently covered in. Such are called *open tunnels*, and are sometimes preferred where the object of the tunnel is to avoid the permanent severance of lands rather than to penetrate ground too elevated for an open cutting. The short tunnel on the London and Birmingham railway, at Kensall Green, was formed in this way. In such cases the sides of the cutting are made nearly vertical, and supported by timbers until the brickwork is executed.

While the projects for some of the principal English railways were before parliament, much discussion took place relative to the ventilation and lighting of tunnels, and to the effect which they might have upon the health of persons riding through them. Most of the objections raised against tunnels during the period referred to are now exploded, and some of them appear not a little ridiculous. It was urged by their opponents that the damp cold air common to all subterraneous excavations would prove highly detrimental to health; that the noxious gases emitted from the locomotive engines would accumulate, and render the air irrespirable; and that the sudden transitions from light to darkness, and *vice versâ*, would be very injurious to the sight. The discomfort arising from these evils, so far as they really exist, and from the deafening noise of tunnel-travelling, are amply sufficient to give a preference to an open cutting, when such a line is obtainable at moderate expense, but they by no means bear out the predictions of the alarmists. Some interesting experiments made in the tunnel on the Leeds and Selby railway are recorded in a paper by Mr. Walker 'On Ventilating and Lighting Tunnels,' in the 'Transactions of the Institution of Civil Engineers,' vol. i., p. 95. While the tunnel alluded to was in progress, it was determined to leave the working shafts open, to promote ventilation and to admit light. The former object was sufficiently attained to prevent any serious inconvenience to passengers, but, so far as the trains are concerned, little benefit is derived from the light admitted by them, although attempts were made to diffuse it by means of tin reflectors. The experiment succeeded so far as to enable a person to read the larger print in a newspaper advertisement in any part of the tunnel; but it is stated that, owing to the rough and dirty state of the walls and the obliquity of the rays thrown upon them, the rays reflected from them were too feeble to be useful in a case of such sudden transition from the light of day as that experienced by persons passing through with a train. Reflectors would also be rendered useless during the passage of a train by the quantity of steam emitted by the engine. In order to settle the question as to the supposed unhealthiness of tunnels, in February, 1837, Dr. Paris, Dr. Watson, Mr. W. Lawrence, lecturer on anatomy and surgery, Mr. R. Phillips, lecturer on chemistry, and Mr. Lucas, surgeon, were requested to visit and report upon the Primrose Hill tunnel. Although the ventilation was then imperfect, owing to the western extremity of the tunnel being unfinished, and the steam was allowed to escape from the engine for a space of twenty minutes, during which it remained stationary in the tunnel, those gentlemen reported that for many feet above their heads the atmosphere remained clear, and apparently unaffected by steam or effluvia of any kind, and that neither damp nor cold was perceptible. They further express their opinion 'that the dangers incurred in passing through well-constructed tunnels are no greater than those incurred in ordinary travelling upon an open railway or upon a turnpike-road; and that the apprehensions which have been expressed that such tunnels are likely to prove detrimental to the health or inconvenient to the feelings of those who go through them are perfectly groundless.' These opinions are fully corroborated by the observations of Drs. Davy, Williamson, and Reid, upon the Leeds and Selby railway tunnel, which, as well as the report on the Primrose Hill tunnel, were given in evidence before the Select Committee of the House of Commons on the London and Brighton Railways, in 1837. The objection arising from darkness is obviated on the London and Birmingham and many other railways by the use of lamps in the roofs of the carriages, which afford an agreeable though small degree of light in the interior; but on the Brighton railway and in a few other cases the tunnels themselves are lighted by gas-lamps attached to the side walls.

Mr. Booth, treasurer to the Liverpool and Manchester Railway Company, contrived and patented a plan for obviating some of the objections to railway tunnels, by making, when practicable, two parallel passages, one for each track, and giving to each a fall or inclination of not less than ten or twelve feet in a mile, in the direction of the traffic to pass through it. As the rails are usually moist, in consequence of the humidity of the atmosphere, the adhesion of the driving wheels is less than upon an open line, and consequently it is desirable, in order to prevent the risk of detention, that the trains should, in passing through a tunnel, be able to roll forward either wholly or partially by the effect of gravity. This is the more desirable from the circumstance that the darkness increases the risk of accident. Another advantage of the plan is that, in the event of an accident occurring upon one track, the passage upon the other would remain unobstructed. The gross amount of excavation need not be much greater than for a single tunnel for two tracks, and the increased space required for making the inclined approaches at each end would not be considerable. A correspondent of the 'Railway Magazine' (vol. ii., p. 219, 8vo series) states that a similar proposition had been made some years previously by Mr. W. D. Holmes, who proposed in many cases to dispense with the locomotive engine, by giving such an inclination to the tunnels as should admit of their being worked by gravity alone.

To the above account of railway tunnels may be appended a list of the most important which have been constructed or are in progress in this country. The length is taken, where practicable, from official documents, and in all cases in which authorities differ, care has been exercised in the selection of those most likely to be correct. The transverse dimensions are not given, because in many cases they could not be ascertained with certainty; but where not otherwise expressed the tunnels are wide enough for two tracks. Those on the London and Birmingham railway are generally 24 feet wide at the widest part, and about 23 to 25 feet high above the rails; and these dimensions may be taken as a fair average. Some of the earlier tunnels are less, especially in the height; those on the Cromford and High Peak, Leeds and Selby, and Liverpool and Manchester railways, range from 16 to 18 feet high; and those on the Great Western railway are, in consequence of the increased width of gauge, in most places about 30 feet wide and 35 feet high within the brickwork. The tunnels are arranged in order of length, and none of less than a quarter of a mile are noticed.

Principal Railway Tunnels in Great Britain.

	Yards.
Summit tunnel on the Sheffield, Ashton-under-Lyne, and Manchester Railway. In progress, intended for a single track	5192
Box tunnel, Great Western Railway	3227
Littleborough or summit tunnel, Manchester and Leeds Railway	2869
Sapperton tunnel, Cheltenham and Great Western Railway, projected	2800
Kilsby tunnel, London and Birmingham Railway	2423
Wapping tunnel, Liverpool and Manchester Railway	2250
Lime Street tunnel, Liverpool and Manchester Railway	2230
Clayton tunnel, London and Brighton Railway	2200
Abbot's Cliff tunnel, South-Eastern (Dover) Railway. In progress, about	2000
Watford tunnel, London and Birmingham Railway	1793
Merstham tunnel, London and Brighton Railway	1780
Leicester and Swannington Railway tunnel, near Leicester, upwards of	1760
Clay Cross tunnel, North Midland Railway, about	1760
White Ball Hill tunnel, Bristol and Exeter Railway. In progress, about	1470
Bishop's Auckland and Weardale Railway tunnel. In progress, about	1364
Wickwar tunnel, Bristol and Gloucester Railway. In progress, about	1320
Shakspere tunnel, South-Eastern Railway, about	1300
Primrose Hill tunnel, London and Birmingham Railway	1250
Glasgow tunnel, Edinburgh and Glasgow Railway*	1250
Balcombe tunnel, London and Brighton Railway	1122
Bletchingley tunnel, South-Eastern Railway	1086
Brislington tunnel, Great Western Railway, about	1050
Saltwood tunnel, South-Eastern Railway. In progress, about	1000
Edinburgh, Leith, and Newhaven Railway tunnel. Projected, for a single track, about	1000
Milford tunnel, North Midland Railway	836
Callander tunnel, Edinburgh and Glasgow Railway	830
Canterbury and Whitstable Railway tunnel, near Canterbury. Single track	822
Festiniog Railway tunnel. In progress	780
Bishopton tunnel, Glasgow, Paisley, and Greenock Railway†	760
Leeds and Selby Railway tunnel, near Leeds	700
Martello tunnel, South-Eastern Railway. In progress	616
Chevet or Roystone tunnel, North Midland Railway, about	[illegible]
Fareham tunnel, Gosport Branch Railway, about	[illegible]
Buxton tunnel, Cromford and High Peak Railway	[illegible]
Edinburgh and Dalkeith Railway tunnel	[illegible]
Bristol and Gloucestershire Railway tunnel. Single track*	[illegible]
Waller's Ash tunnel, London and South-Western Railway, about	[illegible]
Stowe Hill tunnel, London and Birmingham Railway	[illegible]
Patcham tunnel, London and Brighton Railway	[illegible]
Groveley Lane tunnel, Birmingham and Gloucester Railway, about	[illegible]

The Thames Tunnel.—The idea of forming a communica tion beneath the bed of a navigable river, where a fixed bridge would be inadmissible, appears to have originated fro the subterraneous excavations in the coal-districts of th north of England, where there are excavations extendin under the rivers Tyne and Wear. Perceiving from the the practicability of such a scheme, an engineer name Dodd proposed, many years since, to form a subaque passage or tunnel between the towns of North and Sou Shields; and, subsequently, a similar tunnel beneath th Thames, from Gravesend to Tilbury. Neither of the schemes was carried into effect; but the latter was sa tioned by parliament, and the works were actually com menced, about the end of the last century. They were so abandoned; but in 1804 another tunnel was commenc also under the authority of an act of parliament, a lit below the site of the present tunnel. A shaft was sunk o the Rotherhithe side of the river to a depth of 76 feet, an from it a small driftway, about 5 feet high, 3 feet wid at the bottom, and 2 feet 6 inches wide at the top, w excavated in the line of the proposed tunnel, for a distanc of about 1000 feet; when, although within 150 feet of th opposite shore, the undertaking was abandoned, it be considered impossible to conquer the difficulties occasion by the repeated influx of sand and water. In 1823 anoth plan was brought forward by Mr. (now Sir) Isambard Ma Brunel, in which it was proposed to form at once, with a preliminary driftway like that before attempted, an ex cavation of sufficient size to contain two distinct archway each large enough to have a single carriage-way and footpath. He proposed to effect this object by means o framework, or shield, which should support the face of excavation; and allow the earth to be removed on m points simultaneously, without exposing any considera portion in an unsupported state; an idea suggested, it said, by the operations of the destructive worm called teredo, which bores its way into the hardest wood. Pa liamentary sanction having been obtained by the promote of the scheme, operations were commenced early in 182 by the construction of a shaft 50 feet in diameter, at a di tance of 150 feet from the Rotherhithe side of the river, a a point about two miles below London Bridge. The sh was built on the surface to the height of 42 feet, the bri work being 3 feet thick, and laid on a ring of cast-ir with a chisel-shaped edge projecting downwards from outer extremity. Iron-rods were passed up through brickwork from this foundation-ring to another placed the top of the shaft; and the brickwork, which was laid cement, was further bound together by timber-hoops ha an inch thick. This cylinder of brickwork was then gra dually sunk into the earth by the excavation of the grou within it, which was drawn out by a steam-engine mount on the top. In this way the shaft was passed through bed of wet sand and gravel 26 feet deep, which had occa sioned much difficulty in the sinking of the shaft for th driftway previously attempted, and was sunk until it upper extremity was about on a level with the ground, an the lower at the level of the top of the intended tun after which the brickwork was continued downwards to feet. A smaller shaft of 25 feet diameter, intended as well or reservoir for water drawn out of the tunnel drain was sunk still deeper; but at about 80 feet from the su face the ground suddenly gave way, and a quantity of sa and water was blown up. The excavation for the tun was of an oblong square form, 38 feet wide and 22 feet inches high, presenting a sectional area of 835 square fee or more than sixty times that of the drift previously attempted; and in order to leave a sufficient depth of ground above the brickwork in the middle of the river, it was formed with a declivity of 2 feet 3 inches in 100 feet. The shield by which the excavation was effected consisted of twelve massive frames of iron, of the form represented in *Fig.* 3, placed side by side, and capable of being slid forward for a short distance independently of each other.

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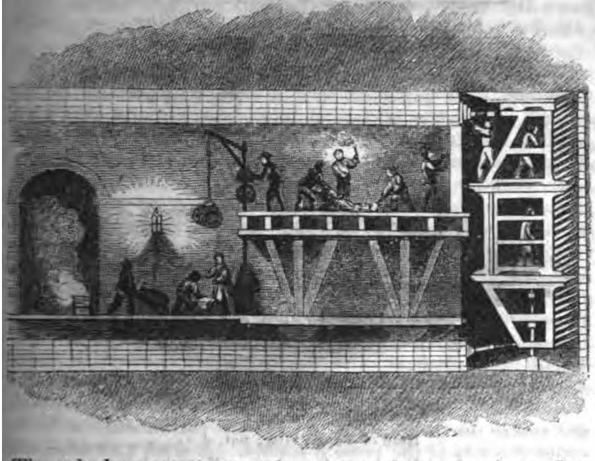
* This tunnel is divided, by two large openings, or *eyes*, into three portions of 176, 292, and 272 yards respectively.

† Divided into two portions, of 320 and 340 yards respectively, by an *eye* 100 yards long.

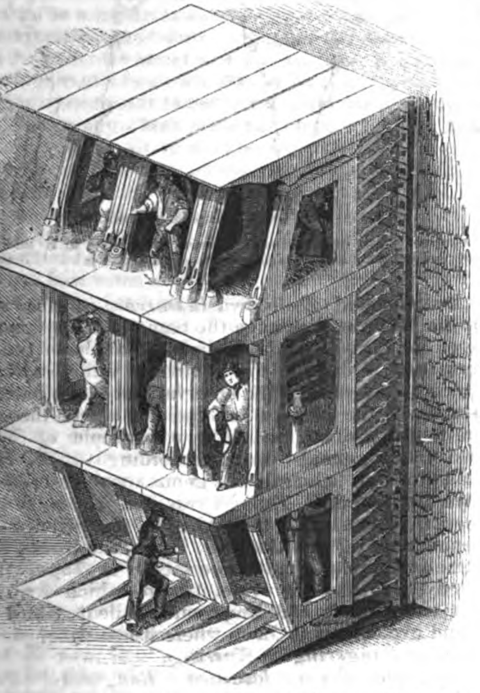
* To be enlarged by the Bristol and Gloucester Railway Company, un the powers of their act of 1839.

Fig. 3.



The whole apparatus may be compared to a massive cofferdam laid on its side, and capable of being moved forward by the action of screws abutting against the end of the completed brickwork, which followed it up closely. This is shown in *Fig.* 4, which represents a longitudinal section of the tunnel, illustrative of the mode of carrying on the works.

Fig. 4.



The flat soles at the bottom of the shield supplied a firm base, which might be readily slid forward, and the top and sides were securely closed in by flat plates, which, being supported by massive framing, and fitting close to the brickwork, effectually prevented the falling in of the soft earth. Each frame of the shield consisted of three stories, each of which formed a cell large enough for one man to work in conveniently; and the front of every cell was protected by a series of narrow poling-boards, each of which was separately held in its place by an apparatus which allowed of its being fixed either on a vertical line even with the face of the shield, or a few inches in advance of such line. The miner commenced by removing the upper poling-board in his division of the shield, and excavating the small portion of earth thus exposed, to the depth of about six inches; he then replaced the poling-board, causing it to press, by means of jack-screws, against the face of the excavation, and removed the second board, thus exposing a fresh portion of earth for removal. When all the poling-boards in one frame of the shield had been thus advanced six inches, the frame itself was pushed forward, and the same series of operations was repeated. The several frames or divisions of the shield were thus alternately moved forward, by slow and cautious steps, and closely followed by a solid mass of brickwork, enclosing two arched passages 16 feet 4 inches in height from the invert to the crown of the arch, and 13 feet 9 inches span at the springing of the arch. The arch, the invert, and the curved side-walls are laid in concentric rings; and the total thickness of the brickwork at the thinnest points, or those at which the inclosed arches approach nearest to the boundary of the rectangular mass of brickwork, is 3 feet. A solid wall, 3 feet 6 inches thick at the top, and 4 feet at the bottom, was built between the arches; and, as the work proceeded, a series of small transverse arches, forming openings from one tunnel to the other, were cut through it. One of these arches is shown in *Fig.* 4, which also represents the moveable scaffold that followed the shield, for the use of the workmen employed in building the tunnel. The whole of the brickwork is laid in Roman cement, and each archway is, or will be, finished with a lining of cement, a carriage-road, and a narrow footpath adjoining the central wall. A brick drain is laid down from the centre or lowest point of the tunnel to the Rotherhithe shaft, by means of which any water that percolates through the brickwork may be removed. The water from the remaining half of the tunnel flows into the drain, owing to the inclination of the roadway.

The excavation of the tunnel was commenced in January, 1826, in a stratum of clay; but, before a month had elapsed, great difficulties were experienced from cutting into a break, or fault, filled with sand and gravel. Notwithstanding this obstacle, which was passed through after thirty-two days of anxious labour, 350 feet of the tunnel were completed in the first year. Moist clay was occasionally forced through the shield, and cavities in the bed of the river were repeatedly filled with bags of clay, to prevent the water from breaking through. The nature of the ground is indicated by the circumstance of a shovel and hammer, which had been accidentally left in the river during an examination with the diving-bell, being subsequently found in a mass of loose earth which broke into the tunnel, they having descended eighteen feet through the earth. The works were further continued until the 18th of May, 1827, when the river broke in with such violence as to wear the brickwork at the entrance of the tunnel to about one-half of its original thickness. No lives were lost on this occasion, nor did the finished part of the tunnel suffer any material injury. The cavity in the bed of the river having been filled up, and the tunnel pumped dry, the works were recommenced under circumstances of extraordinary difficulty and danger, arising from bursts of earth, water, and inflammable gases; but in the following January another irruption of the river stopped the works, overwhelmed some of the miners, and led to an apprehension, on the part of many, that the tunnel could never be completed. The new fissure was stopped by about 4000 tons of soil, and the tunnel was again freed from water; but, owing to the exhaustion of the Company's funds, the works were not recommenced until January, 1835, when, after repeated applications, Government agreed to advance money for their completion. A new shield was substituted for that injured by the irruption, and since that time the tunnel has advanced steadily to completion, although sometimes the excavation has proceeded at the rate of only a few inches per week, and three more irruptions of the river have taken place. As the tunnel approached the Wapping shore, a shaft was commenced on that side of the river, similar to that at Rotherhithe; and on the 13th of August, 1841, Sir I. M. Brunel passed from this shaft into the tunnel along a small driftway. The excavation has since been completed, and now (December, 1842) nothing is required beyond the completion of the permanent staircases in the Rotherhithe shaft to prepare the tunnel for use by foot-passengers. The approaches for carriages, which are proposed to be by spiral roads formed round the sides of shafts, or circular excavations, 200 feet in diameter, are not yet commenced. The tunnel is 1200 feet long between the two shafts; and it is expected that the total cost of its formation, with the approaches, will be between 600,000*l*. and 700,000*l*., which is far less than the cost of the modern metropolitan bridges. A detailed account of the progress of the undertaking is given in Knight's 'London,' vol. iii., No. 54.

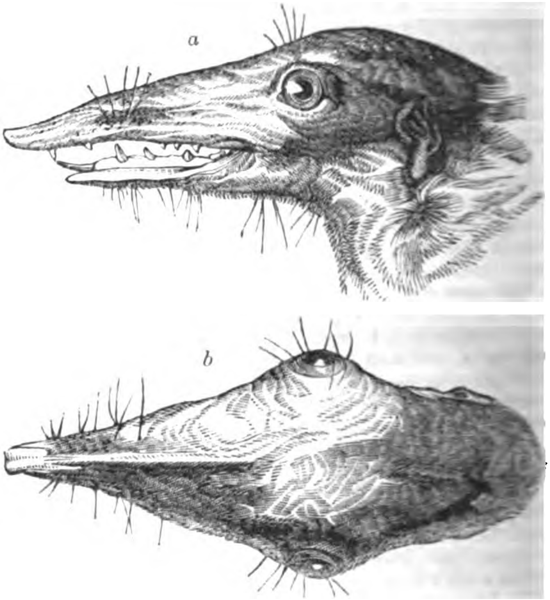
TUNSTALL, JAMES, D.D., was born about the year 1710, and educated at St. John's College, Cambridge, of which he afterwards became a fellow and tutor. In 1739 he obtained the rectory of Sturmer in Essex, and two years later he was appointed chaplain to Potter, archbishop of Canterbury. In 1744 the University of Cambridge conferred upon him the degree of D.D. After having held the office of chaplain for several years, he received from the archbishop the rectory of Great Chart in Kent, and the vicarage of Minster in the Isle of Thanet. He resigned both places in 1757 for the more lucrative vicarage of Rochdale in Lancashire, which was given him by Archbishop Hutton, to whom he was related by marriage. He remained here until his death, on the 28th of March, 1772, although he was from the first much disappointed in the expectations which he had entertained concerning his position at Rochdale. This disappointment, together with various troubles in his family, is believed to have hastened his death.

Dr. Tunstall was a man of a most amiable and humble character; when he left the place of chaplain to the archbishop of Canterbury it was said of him, that of all the humble men that had ever held that office, he was the only one that remained humble when he left it. He was a scholar of considerable ability, although he has not done much. But there are some points which he has settled. The work to which we allude is his letter to Dr. Middleton, 'Epistola ad Virum eruditum C. Middleton,' Cambridge, 1741, 8vo. In this letter he questions the genuineness of the collection of the epistles between Cicero and Brutus, entitled 'Epistolae ad Brutum,' which Middleton had made use of without any doubts as to their genuineness, while, according to the opinion of Dr. Tunstall, he had not paid sufficient attention to Cicero's letters addressed to his brother Quintus and to Atticus. His views respecting the doubtful character of the correspondence between Cicero and Brutus were further developed in an English essay, 'Observations on the present Collection of Epistles between Cicero and Brutus.' These two dissertations have so far settled the question respecting the authenticity of those epistles, that all the subsequent editors of Cicero have regarded them at least as very doubtful. The other works of Dr. Tunstall are of a theological or theologico-political character:—1, 'A Sermon before the House of Commons,' May 29, 1746, 4to.; 2, 'A Vindication of the Power of the State to prohibit Clandestine Marriages,' 1755, 8vo.; 3, 'Marriage in Society stated, with some Considerations on Government;' 4, 'Academica, Part the First, containing Discourses upon Natural and Revealed Religion, a Concio and a Thesis.' The second part of this work did not appear during the author's lifetime; but it is generally believed that the 'Lectures on Natural and Revealed Religion,' which were edited after his death by his brother-in-law, the Rev. Mr. Dodsworth, were intended by the author to form part the second of his 'Academica.' In the British Museum there exists a collection of letters forming the correspondence between Tunstall and the earl of Oxford, in the years 1738 and 1739, on the subject of Ducket's atheistical letters.

(Nichols, *Anecdotes of Literature;* Aikin, *General Biography.*)

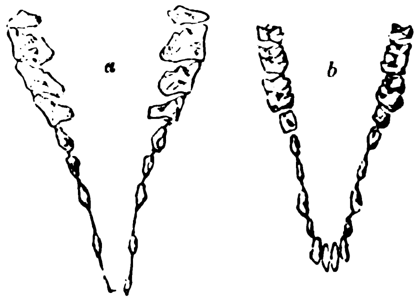
TUPAIA, Sir T. Stamford Raffles's name for a genus of mammals which Dr. Horsfield places among Cuvier's *Insectivorous Carnassiers*, the *Feræ* of Linnæus, and the *Falculata* of Illiger.

Generic Character.—*Head* oblong, depressed. *Snout* long, equally attenuated; nostrils lateral, semilunar. *Eyes* very large and rather prominent. *Ears* large and oblong. *Body* cylindrical, covered with close fur and soft hairs. *Tail* longer than the body, linear, compressed. *Feet* plantigrade and pentadactyle, the soles naked, the toes compressed, and the claws falcular.



Head of Tupaia tana; nat. size.
a, profile; *b*, seen from above. (Horsfield.)

Dental formula:—incisors, $\frac{2}{6}$; canines, $\frac{2}{2}$; molars, $\frac{14}{12}$



Teeth of Tupaia Javanica.

a, upper jaw: in this view the animal is supposed to be laid on its back, and the spectator to be looking down on the upper jaw. *b*, lower jaw seen from above. (Horsfield.)

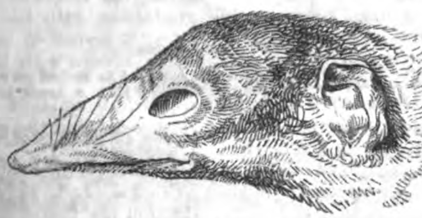
Dr. Horsfield (*Zoological Researches in Java*) states that in the Malayan language the name of *Tupai* is a general term for various small animals which have the external form and agility of the squirrel; while each different species, agreeably to the observations of the natives of the islands of the Eastern Archipelago, where these animals are found, is distinguished by a particular epithet. Thus two small animals which, according to Dr. Horsfield's classification, belong to the genus above described, are, he says, denominated *Tupai Press* and *Tupai Tana;* while several other animals belonging to the genus *Sciurus* are denominated *Tupai Jinjang*, *Tupai Tankrawa*, &c. The same author states that three species of *Tupaia* had been discovered when he wrote, two of which are natives of Sumatra, Penang, and Singa-pura, while the third has been found exclusively in Java, where it is distinguished by the name of *Bangsring* or *Sinsring*.

Example, *Tupaia Javanica; Bangsring* or *Sinsring* of the Javanese.

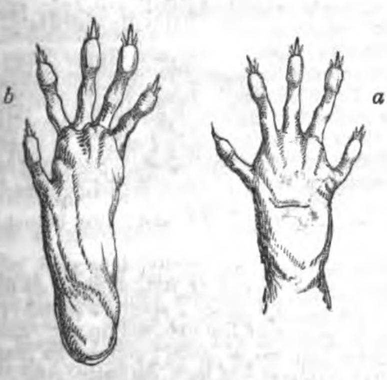
Dr. Horsfield says that this species has the appearance of a sprightly animal, a character with which its manners, as far as they are known, perfectly agree. 'Its body,' says Dr. Horsfield, is graceful and handsomely formed, and its limbs are slender and fitted for great agility: its size and exterior habits so nearly resemble the individuals of that family which Illiger has denominated *animalia agilia*, that, on a superficial view, it has been considered to belong to it. Our animal agrees with one of the most numerous sections of this family, the Squirrels, in the form of the body the proportional length of the extremities, the breadth of the tail, and the faculty of carrying it on the back as a plume; but the succeeding details will show that its structure and organization are essentially different.'

Dr. Horsfield then gives the following

Description.—The head is oblong, rather depressed, and very gradually attenuated to a conical muzzle, which is somewhat compressed laterally. The nose is obtuse and naked. The nostrils are slightly curved, somewhat broader in the middle, and pierced from the sides. The upper jaw surpasses the lower but little in length. From the upper lip are protruded mustaches, consisting of numerous short slender hairs, and a few solitary bristles arise from the cheeks and chin. The eyes are very large and prominent, and situated at an equal distance from the gape or opening of the jaws and from the crown of the head: the pupil is circular, and the irides are dark. The ears offer some peculiarities both in their disposition and form. They are externally provided with a large helix, which, being margined in the upper part, passes in an angle to the sides, where a well-defined antihelix runs parallel to it, and between both patches of short hairs are scattered without regularity. The tragus is of moderate size and naked, representing a scale, which is inflected in part over the meatus auditorius externus, and is calculated to cover it entirely whenever the economy of the animal requires this organ to be protected. The antitragus is naked, and occupies a considerable portion of the auricular cavity. The ears are situated far behind, near the commencement of the neck, which is of moderate length, and differs but little from the head in dimensions. The anterior extremities are slender, and somewhat shorter than the posterior: the latter are considerably more robust, and the thighs are muscular, and calculated for vigorous exertion. The feet are plantigrade, and the soles perfectly naked; the tarsi of the posterior extremities are considerably longer than those of the anterior, and the manner in which the feet are placed on the ground gives a peculiar character to the gait and appearance of the animal. Each foot is provided with five slender, compressed, distinct toes. The three intermediate toes have a similar disposition in both extremities; the middle toe scarcely exceeds the lateral ones in length. The small toe is shorter, and placed more posteriorly. The thumb is perfectly distinct, and moveable in a direction opposite to the others; in the hind foot it is placed at a greater distance from the toes than in the fore foot.



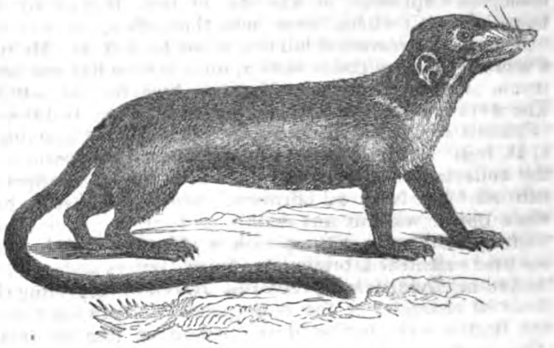
Head of Tupaia Javanica. (Horsfield.)



a, fore foot of Tupaia Javanica; *b*, hind foot of the same. (Horsfield.)

Dr. Horsfield further describes the claws as sharp, compressed, and curved; and, in comparison with those of *Sorex* and several other genera of this order, of considerable strength: they are, he observes, individually supported by a small protuberance similar to that which is found in the *Tarsii;* and the construction of the claws in the Bangsring is adapted, he remarks, to the same food and habits as those of the other species of *Tupaia*. The linear tail, of the same length as the body, is compressed, with the hairs spreading far on each side; but, adds Dr. Horsfield, it is less full and ornamental than in the squirrel. The fur of the bangsring is close, silky, and delicate, with a few longer, more rigid, and darker-coloured hairs dispersed among the long and straight hairs closely applied to the skin, with which the back, neck, sides, tail, and extremities above are furnished. The upper parts are brown, slightly diversified with grey of different shades; the lower parts dirty white, with a slight tint of greyish: the tail agrees with the upper parts; and the scapular line, which is nearly an inch long, agrees with the neck.

Food, Habits, &c.—The *Bangsring* fell under Dr. Horsfield's observation during an early period of his researches in Java. In traversing the province of Blambangan, in 1806, he discovered it in the extensive forests which almost entirely cover the eastern extremity of the island; and he thinks that its range, though it may not be confined exclusively to that province, is extremely limited. From the scanty information afforded by the natives, it would seem that the bangsring lives on trees, and feeds 'on fruits and nuts;' but Dr. Horsfield observes that this intelligence must be received with due limitation, and he refers to the system of dentition as indicating that the bangsring is more adapted to animal than vegetable food. Length from extremity of nose to the root of the tail, 6 inches 5 lines; of tail 6 inches 5 lines.



Tupaia Javanica. (Horsfield.)

Sir Stamford Raffles states that a tame *Tupaia ferruginea* was suffered to go about at perfect liberty, ranged in freedom over the whole house, and never failed to present himself on the breakfast and dinner table, where he partook of fruit and milk. Dr. Horsfield also quotes an extract from the 'Proceedings of the Asiatic Society,' where it is stated that a living *Tupaia ferruginea* was brought to Bengal by a medical gentleman; it ran about the house tame, but would not allow itself to be caught for close inspection. Though at liberty to run out of doors whenever it liked, it showed no disposition to leave its quarters, and evinced some attachment to the family; for whenever strangers entered the house it showed disquietude and made a chattering noise. It gave no trouble in feeding, for it was always on the search after insects, and its favourite food seemed to be flies, crickets, grasshoppers, and cockroaches.

Dr. Horsfield observes that although *Tupaia* has been placed among the *Insectivora*, its arrangement in a natural system requires further consideration. It is necessary, he remarks, for this purpose that we should be more fully acquainted with its internal structure and with its habits and manners than we are at present; for although in certain characters it approaches near to the genera *Sorex* and *Mygale* [SORECIDÆ] among the *Insectivora* [CARNIVORA], yet in others it strongly resembles TARSIUS among the Quadrumanes; and withal it is masked by the external form and appearance of the Squirrel.

TUPINAMBIS. [MONITORS.]

TUPISTRA, a genus of plants nearly allied to the natural family of Smilaceæ. It has been so named from the

Greek word *tupis* (τυπίς), a mallet or hammer, on account of the peculiar form of the flowers. The genus is little known, but has sometimes been cultivated in our hothouses. The flowers are densely spiked. Perianth corol-like, bell-shaped. Stamens 6 to 8, inserted in the tube of the perianth. Ovary subcylindrical, very small, 3-4 celled. Ovules 2 in each cell. The species are found in the islands of the Indian Ocean and in the hot and moist parts of India. They are stemless, with a thick tuberous rhizoma, annulate from the insertion of the bases of the leaves, the leaves are two-rowed, petiolate, oblong, lanceolate, nerved and striated, with a central scape; flowers of a dirty violet colour. *T. squalida*, from Amboyna, is figured in *Bot. Mag.*, t. 1655, and *Bot. Reg.*, t. 1223.

TURBARY, COMMON OF, is a right to dig turf in another man's land, or in the lord's waste. This description of common right may be appendant or appurtenant to a house, but not to land; for the turfs dug in virtue of the right are to be burnt in the house. The right is therefore confined to such quantity as is sufficient for the consumption of the house to which the common of turbary is appendant, and never extends to a right to dig turf for sale.

Where common of turbary is appurtenant to a house, it will pass by a grant of the house with the appurtenances. (2 Rep. 37, *Common.*)

TURBINA'CEA, M. de Blainville's name for his sixth family of *Polythalamacea*, including the genera *Cibicides* and *Rotalites*, microscopic Foraminifera. For Lamarck's *Turbinacea*, which might include M. d'Orbigny's *Scissurella*, see Turbinidæ.

We shall here shortly describe *Scissurella*.

Shell subglobose, umbilicated, with a spiral groove terminating at the margin of the outer lip in a slit; spire short, aperture oval, modified by the last whorl; outer lip trenchant with a deep fissure near the spire.

The *Scissurellæ* are small shells, and may be known from *Pleurotomaria* by their short spire. *Scissurella elatior*, a figure of which is given by Mr. G. B. Sowerby, Jun., in his useful 'Conchological Manual,' may be taken as an example.

TURBINELLA. [Siphonostomata, vol. xxii., p. 52.]

TURBI'NIDÆ, a family of gastropodous mollusks.

Linnæus placed his genus *Turbo*, in his last edition of the 'Systema Naturæ,' between *Trochus* and *Helix*, with the following characters:—

Animal a Limax or Slug. *Shell* univalve, spiral, solid. *Aperture* narrowed, orbiculate, entire:

And he divided the species into the following sections:—

*

The *Neritoidei*, with the columnar margin of the aperture flat and imperforate.

Four species, viz. *Turbines obtusatus, neritoides, littoreus*, and *muricatus*.

* *

The *Solidi* imperforate.

Thirteen species, viz. *cimex, pullus, personatus, petholatus, cochlus, chrysostomus, tectum persicum, pagodus, calcar, rugosus, marmoratus, sarmaticus*, and *olearius*.

* * *

The *Solidi* with a perforated umbilicus.

Six species, viz. *pica, sanguineus, argyrostomus, margaritaceus, delphinus*, and *distortus*.

* * * *

The *Cancellati*.

Twelve species, viz. *crenellus, thermalis, scalaris, clathrus, ambiguus, crenatus, lacteus, striatulus, uva, corneus, reflexus*, and *lincina*.

* * * * *

The *Turriti* properly so called.

Fifteen species, viz. *imbricatus, replicatus, acutangulus, duplicatus, exoletus, terebra, variegatus, ungulinus, annulatus, bidens, perversus, muscorum, auriscalpium, politus*, and *nautileus*.

This congregation is somewhat heterogeneous, containing marine, land, and fresh-water testaceous mollusks, the majority breathing by means of gills, but others pulmoniferous, and breathing atmospheric air only.

The *Turbinacea* of Lamarck belong to his first section of *Trachelipods*, and constitute the last family of his phytiphagous or plant-eating Trachelipods, those, namely, which in general have no proboscis, but a muzzle with two jaws, and which appear to be simply herbivorous;* those, finally, whose shell offers at the base of its aperture neither notch directed backwards nor any canal whatever. All are marine shells, conoïd or turriculate, and appear to be provided with an operculum. When one of these shells is placed on its base, its axis is always inclined more or less, and is never vertical. (*Animaux sans Vertèbres.*)

Lamarck's *Turbinacea* consist of the genera *Solarium*, *Rotella, Trochus, Monodonta, Turbo, Planaxis, Phasianella*, and *Turritella*.

The *Sabots* (*Turbo*, Linn.) of Cuvier comprise the *Sabots* properly so called (*Turbo*, Lam.); *Pleurotomaria*, of which he considers the *Scissurellæ* of D'Orbigny living species [Turbinacea]; Turritella, Lam.; *Scalaria*, Lam., and the terrestrial and fresh-water genera *Cyclostoma*, Lam., and *Valvata*, Müll.). [Trochidæ, ante, p. 267.]

Cuvier thus makes the *Sabots* (*Turbo*, Linn.) comprehend all the species which have a completely and regularly turbinated shell with a mouth entirely round.

The *Sabots* properly so called (*Turbo*, Lam.) Cuvier describes as having a shell round or oval, thick, and with the mouth completed on the side of the spire by the penultimate whorl. The animal has, he tells us, two long tentacles, with the eyes carried on pedicles at their external base, and on the sides of the foot membranous alæ, which are sometimes simple, sometimes fringed, sometimes furnished with one or two filaments. It is to some of these, he observes, that those stony and thick *opercula* remarkable in collections belong, and which were once employed in medicine under the name of *Unguis adoratus*. There are some of them, he adds, umbilicated (*Meleagris*, Montf.) and others not umbilicated (*Turbo*, Montf.). (*Règne Animal.*)

The *Cricostomata* of M. de Blainville consist of the genera *Turbo, Pleurotomarium, Delphinula, Turritella, Proto, Scalaria, Vermetus, Siliquaria, Magilus, Valvata, Cyclostoma*, and *Paludina*.

M. de Blainville thus defines the genus *Turbo*, Linn.:—

Animal slightly variable, rather however with reference to the form and proportion of certain external parts than to the totality of its organization, and bearing a general resemblance to that of *Trochus*.

Shell equally variable in its general form, but the aperture of which, always nearly circular, is completely closed by a calcareous or horny operculum, with but few spiral whorls, and with a sublateral apex.

M. de Blainville observes that this family is really hardly distinct from the *Goniostomata* (*Trochus*, Linn.), which precede it; and, in fact, he remarks, the Linnæan genus *Trochus* is fused by insensible gradations into his genus *Turbo*; and he says that it is only with a view of making the conchological system of Linnæus accord with that of modern authors that he has established it.

The animals of this family appear, he adds, to be all phytiphagous; a small number respire air, and the greater part of the species are marine. (*Malacologie.*)

With regard to M. de Blainville's observation touching the slight distinction between *Trochus* and *Turbo*, we would recall to the reader's recollection the figure and description of *Trochus imperialis*, the operculum of which determined MM. Quoy and Gaimard to place it among the *Turbines*. [Trochidæ, ante, p. 270.]

The following is M. de Blainville's definition of his genus *Turbo*:—

Animal nearly entirely resembling that of the *Trochi*, the sides of the body capable of being ornamented with tentacular appendages differing in number and form: head proboscidiform; tentacles slender, setaceous: eyes often subpedunculate, mouth without a labial tooth, but provided with a very long lingual riband rolled spirally, and contained in the abdominal cavity; a transversal furrow at the anterior border of the foot; two branchial pectinations.

Shell thick, nacreous internally, depressed, conical, or subturriculate, umbilicated or not, slightly or not at all carinated on its circumference; aperture round or slightly depressed; the middle of the external lip not bent (coudé), but sometimes notched at some point of its extent; the borders or lips rarely united by a callosity; the columella bent, rarely twisted, and sometimes terminated by a strong tooth at its point of junction with the columellar border.

Operculum calcareous or horny; the spire visible on the external side in these last, and on the internal side in the others; the external side often thick and furrowed (guilloché).

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* But see post, Phasianella.

M. de Blainville divides the genus into the following sections:—

A. Subturriculate species with an oblique aperture; columella excavated and without teeth.

Example, *Turbo albescens.*

B. Subtrochoïd species with a rather low spire; the borders of the lip evidently disunited; the columella twisted, terminated by a great oblique dentiform plait; a large umbilicus. (Genus *Clanculus*, Montf.)

Example, *Turbo Pharaonis.*

C. Less trochoid species, subglobular, umbilicated or not, with the whorls of the spire rounded; the columella terminated by a tooth. (Genus *Monodonta*, Lam.; *Labio*, Oken.)

Example, *Turbo Labio.*

D. Species more or less globular, whose nearly straight columella offers only a small *arrêt* at its junction with the lip.

Example, *Turbo fragarioïdes.*

E. Species in which the aperture is oblique, the columella losing itself entirely in its continuation with the lip, and which are not umbilicated.

Example, *Turbo rugosus.*

F. Species which, with the same characters, have the umbilicus always open. (Genus *Meleagris*, Montf.)

Example, *Turbo pica.*

G. Species in which the rather straight columellar border terminates the shell forwards.

Example, *Turbo argyrostomus.*

H. Species whose columellar border forms a still greater advance, and whose spire is entirely flat.

Example, *Turbo coronatus.*

I. Species whose aperture is perfectly round in the direction of the axis; operculum horny. (Genus *Littorina*, Féruss.)

Example, *Turbo littoralis.*

J. Species whose aperture is a little semicircular and the spire lateral and flattened; operculum horny.

Example, *Turbo neritoïdes.*

M. de Blainville observes that Lamarck characterises twenty-three living species of *Monodonta*, but no fossil species; thirty-four living species of *Turbo* and four fossil. M. de Blainville further adds that species of the genus as limited by him occur in all seas, and that there are ten or twelve in the French seas, only one of which is a *Monodonta.* He then refers to Defrance as having announced fifty fossil *Monodontæ* and twenty-eight fossil *Turbines*, three of which are identical with living species—two in the Plaisantin, and one in England; and concludes his remarks by stating that the character of the operculum may serve to confirm the sections of this genus; and that the *Monodontæ* may belong to the preceding family *Trochus*): in fact the species of our seas has a multispiral operculum.

M. Rang thus characterises the *Turbinés* of Férussac, which he makes the first family of the *Pectinibranchiata*:—

Animal furnished with two subulate contractile tentacles; the eyes at their base.

Shell variable in form, with a rounded or oval aperture, the borders but slightly or not at all disunited, without either canal or notch.

Operculum horny or calcareous.

Fluviatile or marine.

Subgenera:—*Paludina*, *Melania*, *Rissoa*, *Littorina*, *Turritella*, *Proto*, *Vermetus*, *Siliquaria*, *Magilus*, *Valvata*, and *Natica.*

The *Turbinés* are immediately followed by the *Trochoides* in M. Rang's arrangement.

Mr. Swainson's views with regard to *Turbo*, to a certain extent, are stated in the article TROCHIDÆ, ante, p. 268.

His family *Turbidæ*, placed between the *Helicidæ* and the *Naticidæ*, contains the following subfamilies and genera. We should premise that he characterises the family as having a shell solid, but not perlaceous, spiral: aperture entire, closed with an operculum.

Subfam.? Thallicera.

Genus *Thallicera*, Quoy.

Subfam. Ampullarinæ.

Genera:—*Valvata*; AMPULLARIA (with the subgenera *Ampullaria*, *Pachylabra*, *Lanites* (Lanistes?), and *Ceratodes*); *Paludina* (with the subgenera *Paludina* and *Nematura*); *Meladomus.*

Subfam. Melanianæ.

Genera:—*Paludomus* (with the subgenera *Paludomus*, *Anculosa*, and *Hemimitra*); *Melania* (with the subgenera *Melacantha*, *Melania*, *Potadoma*, *Hemisinus*, and *Melanella*); *Melanopsis* (with the subgenera *Melanopsis*, *Melanithes*, *Canthidomus*, and *Melatoma*); *Cerithidea* (with the subgenera *Triphorus*, *Cerithidea*, and *Ceriphasia*); *Planaxis.*

Subfam. Turbinæ.

Animal marine; shell solid, spiral; aperture round or oval, entire, sometimes toothed.

Genera:—*Scalaria*; *Turritella* (with the subgenera *Rissoa*, *Turritella*, *Eulima*, *Pyramidella*, and *Truncatella*); *Turbo*, Linn. (with the following character:—shell turbinate; spire short, generally pointed, not longer than the aperture; inner lip flattened, broad. Example, *Turbo littoreus*, 'the common winkle'); and the subgenus *Tornatella*; *Melampus* (with the subgenera *Geovula*, *Pedipes*, *Scarabus*, *Melampus*, and *Rhodostoma*); *Scissurella.*

In a note to *Turbo* Mr. Swainson says that *Tuba*, *Assiminea*, and *Monotigma* may be subgenera, but he is not acquainted with them; and as their animals appear to be unknown, he is fearful of locating them incorrectly. Of *Tornatella* he says that it possibly unites *Turbo* to *Melampus*, giving as a reason that it is the only one which has that sort of colouring peculiar to marine shells. (*Malacology.*)

Mr. J. E. Gray makes the *Turbinidæ*, the first family of the first section (*Podophthalma*) of his second order (*Phytophaga*) of the 1st class (*Gasteropoda*) of the subkingdom Mollusca, consist of the following genera:—

Turbo, *Batillus*, *Imperator*, *Trochiscus*, *Phasianella*, *Thicolia.*

The *Turbinidæ* are immediately succeeded by the *Trochidæ.* (*Synopsis Mus. Brit.*)

Turbo.

MM. Quoy and Gaimard, who give a figure illustrative of the anatomy of *Turbo marmoratus*, the largest and perhaps the best-known species of *Turbo*, select the animal as the type of the organization of the genus, and thus describe its structure:—

The *head* is large, escutcheoned (ecussonée), heart-shaped, and provided with two short, slender, obtuse tentacles, coming out from between the ocular peduncles; and there is an internal prismatic appendage, which MM. Quoy and Gaimard call a *palmette*, because it is frequently digitated. The peduncles, which carry very small eyes at their extremity, are themselves triangular. The mouth is elongated into a sort of very moveable proboscis, enlarged, and a little drawn in (rentrée) at its extremity, expanding more or less largely on the foot. From the base of the eyes issues a fleshy, undulated, and sometimes filamentous fringe, which loses itself on the sides of the root of the foot, which last is very large, thick, and oval, carrying a stony *operculum*, which is convex above, and membranous and paucispiral on its lower surface. It is, perhaps, the largest and heaviest of all known opercula.

The pulmonary cavity is very large, horizontally divided by a membrane, on which are applied, above and below, the branchial lamellæ. This organ, then, observe MM. Quoy and Gaimard, is double, and a little oblique from left to right; its single point is free, and directed towards the right edge of the mantle. It even appears a little externally. Below this partition, and on the same side, are seen the following organs:—1st, the free and fringed point of the anus; 2nd, the tube, in form of a proboscis, of the organ which secretes the purple dye. It penetrates into a large lamellose cavity, above which repose the end of the intestine and the body of the uterus: 3rd, farther backwards, the uterus, of a cylindrical form, the linear crescent-shaped aperture of which is not terminal, but placed above. Its internal walls are villous and velvety. It is the same, observe the describers, in the *Monodontæ* of our coasts.

MM. Quoy and Gaimard do not know what purpose is served by a large fasciculus of tubes coadapted to each other, separated transversely by another tube, applied upon the rectum and corresponding to the uterus. As this organ has some analogy with the circumvolutions of the uterus of the *Pterocerata*, MM. Quoy and Gaimard think it may belong to generation. The heart is elongated, very delicate, and attached upon the rectum at the part where it begins to form a loop. It has two auricles, one anterior and the other posterior, to receive the blood from each gill.

The mouth is a fleshy mass, ovoïd, and provided with protractor and retractor muscles, with a horny bifid plate at its aperture, and with a rather long and wide tongue furnished with strong hooks. As in *Parmophorus*, the œsophagus contains four long, membranous, and very villous folds. Its salivary glands form but a moderate bundle placed below.

The tract of the œsophagus is rather long before it enters the liver, where, partially, is placed the stomach, which last is very ample, globular, and divided, as it were, into two compartments internally: the cardiac portion is smooth, folded longitudinally; the pyloric covered with linear granulations, converging towards the aperture. A little farther on, the intestine forms many close-set circumvolutions, whence issues the great loop which terminates by the rectum.

The liver is enormous, and composes of itself nearly the whole of the spiral portion of the animal (*tortillon*), embracing, as has already been observed, a portion of the stomach and intestine into which it pours the bile. It did not appear to MM. Quoy and Gaimard to be easily divisible into lobes. It is covered by an organ consisting of a delicate layer, ordinarily of a different colour, most frequently of a pale yellow, which MM. Quoy and Gaimard suppose to belong to generation. Perhaps, they observe, one might look for the analogue of a penis in the spirally-rolled body seen on the left side of the liver. But though MM. Quoy and Gaimard avow that they have not been able to follow out the relations of this spiral with the uterus or its appendages, they are certain that it has no reference to the tongue.

The nervous system, they observe, differs from that of the other mollusks, in having the upper ring placed very near the mouth, and the lower more backward below the œsophagus. They remark that one may easily overlook it, and take another loop for it, especially in *Haliotis*. Ganglionary points of this nervous circle give off filaments for all parts of the body.

The colour of the foot is grass-green on the sides, slightly brown above, and of a beautiful yellow below; the head is red-brown and striated, with a narrow green band at the base of the eyes and the palmettes. These four appendages are bordered with green, as well as the muzzle, which is striated with brown. The tentacles and the edge of the lateral fringe of the feet are green also. The contour of the mantle is yellow, and the operculum white (we may add, externally, for on the inside it is chestnut).

The anatomy of this *Turbo* is given in the atlas of the Astrolabe (*Zoologie*, pl. 59, f. 10).

Living specimens were brought to the Astrolabe at Amboyna, and there only, by the Malays; and MM. Quoy and Gaimard could not obtain any account of the habits of this species. They add that the inhabitants of Vagiou probably eat it, for they often found the shells of this *Turbo* empty upon the heap of other molluscous shells, from which the natives obtain food. (*Astrolabe.*)

The number of living species of *Turbo*, recorded by M. Deshayes in his tables, is fifty-six.

Examples.—*Turbo marmoratus.*

Description.—Animal (see above).

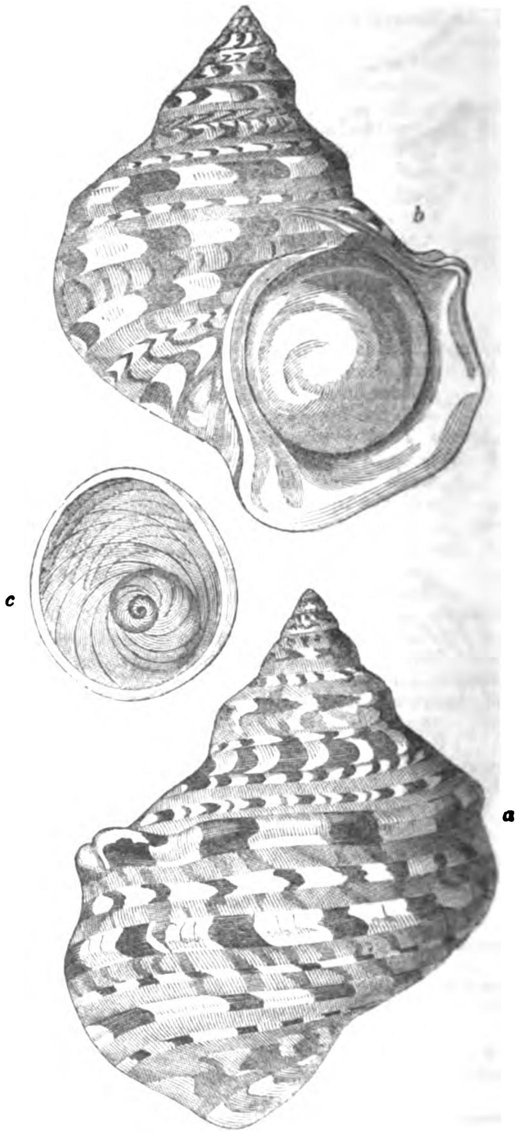
Shell subovate, very ventricose, imperforate, smooth, green marbled with white and brown or subfasciated; the last whorl transversely nodulous in a triple series, the upper nodules greatest; the lip at the base flattened into a short subreflected tail-like process; mouth silvery.

This shell when deprived of its external layer exhibits a silvery, iridescent, and very brilliant nacre.

Turbo torquatus.

Description.—Shell orbiculate-convex, broadly and deeply umbilicated, transversely sulcated, substriated with close-set longitudinal lamellæ of a grey-green colour; whorls above, coronated; the last girt with a median carina; spire blunt at the apex. (Lam.)

MM. Quoy and Gaimard state that the foot of this *Turbo* often takes a quadrilateral form, but it can elongate itself into a trumpet-shape, as they have represented it: it is yellow below, dotted with red-brown on the lateral parts. The mouth is under an enlarged hood, which is notched, greenish, and striated below, striped with red-brown above. The tentacles, moderately long for the size of the animal, are yellowish, annulated with brown. They carry the eyes at their base upon a fringed pedicle. The palmettes are equally laciniated. The lateral fringes of the foot have only a single yellowish filament. The parts contained in the spire are also yellowish, *après la cuisson*. The oval operculum is remarkable for its doubly spiral *guillochure* of a fine white, and granulated.



Turbo marmoratus.

a, View of back; b, view of mouth with the operculum in; c, inside of operculum.

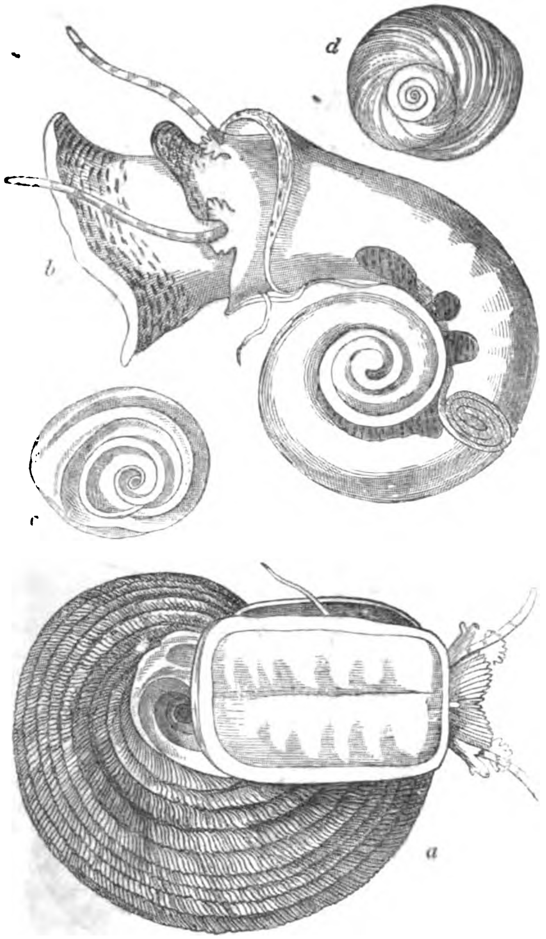
The shell, when deprived of its first layer, is beautifully nacreous.

This species, which grows to a large size, inhabits King George's Sound. Only a few individuals were found alive.

Turbo Cookii.

Description.—Shell orbiculate-convex, with a ventricose dilated base, longitudinally plicate, rough, rufo-fuscescent; the plications very frequent, close-set, oblique, imbricato-squamous; the whorls convex; lower surface rather convex, concentrically rugous, and imperforate. (Lam.)

The *animal* has long, filiform, white tentacles, dotted with red-brown, without palmettes at their internal part: the eyes pediculated. The mouth is elongated in form of a proboscis, or is widened into a hood. It is white, striated



Turbo torquatus.

a, Shell with the animal seen from below ; *b*, the animal out of the shell ; *c*, outside of the operculum ; *d*, inside. (*Astrolabe*.)

transversely with black. The foot is large, yellowish, dotted with brown below, with a median line of the same colour.

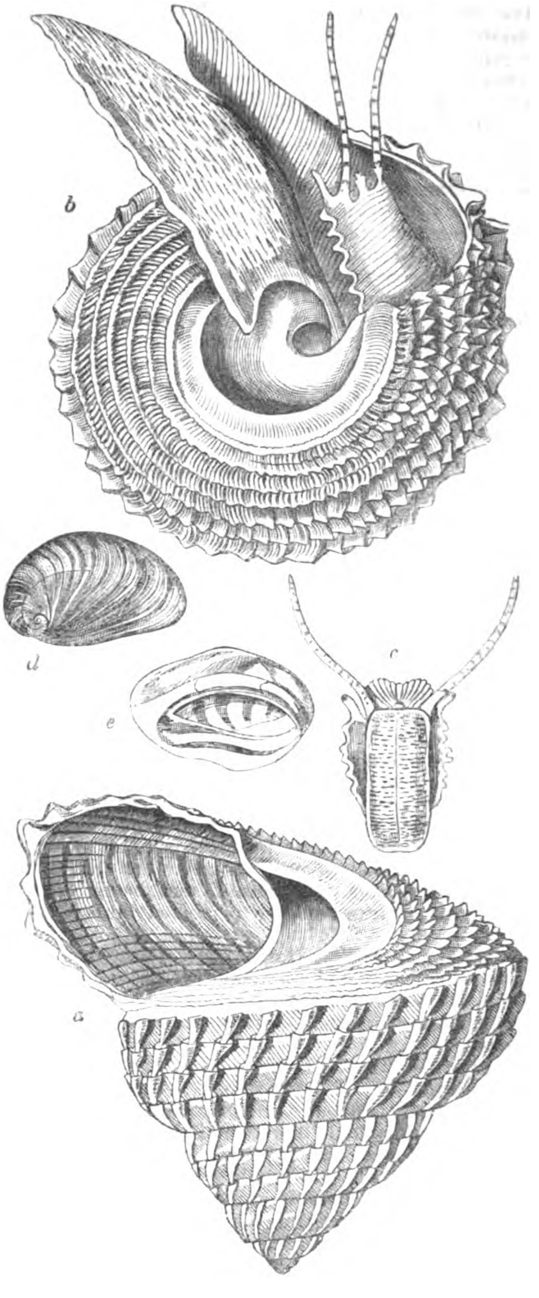
The *operculum* is oval, rounded at one of its extremities with an oblong fosset, sometimes paucispiral. It is white and greenish. Its spiral is less pronounced than in the greater portion of the other *Turbines*.

Locality.—MM. Quoy and Gaimard found this species in great numbers in Tasman's Bay, New Zealand, in the Bight of the Astrolabe (l'Anse de l'Astrolabe), and on the reefs of the Passe des Français. They add that one may judge of its small degree of locomotion from the dirty incrustation, so difficult to be removed, with which the shell is covered. It grows to considerable size. (*Astrolabe*.)

The number of living species above noticed is below the mark, and in all probability does not include the species described by Sowerby and others. (Müller's *Synopsis*.) *Turbo* has been found at depths ranging from the surface to ten fathoms, on rocks and weeds.

M. Deshayes gives thirty-four as the number of fossil species (tertiary), and of these *Turbo rugosus*, a new species, and *T. costatus*, are stated to be found both living and fossil (tertiary). Among the *Fossil Shells from the Western Borders of the Red Sea, communicated by Mr. Greenough to Mr. Lyell*, *Turbines chrysostomus* and *petholatus* are noticed. *Turbines naticoides*, *nitens*, and *lineata*, appear in Mr. Lea's list of new tertiary fossils from Claiborne, Alabama (*Contributions to Geology*). The genus occurs also in the strata below the chalk. Five species are enumerated by Mr. Murchison from the Silurian rocks.

The number of living species of *Monodonta* given by M. Deshayes in his tables is forty-two, and eight are recorded as fossil (tertiary). *Monodonta Pharaonis* is noted as occurring in more than one tertiary formation. Among the fossil Red Sea shells that species and *Monodontæ tectum* and *Ægyptiaca* (all living) are noticed. Mr. Lyell also includes *Monodonta Vieillotii* among the fossil shells from the flanks of Ætna, immediately above the Bay of Trezza. *Monodonta* occurs also below the chalk, in the Portland stone for example. (Fitton's *Stratigraphical List*.)



Turbo Cookii.

a, Shell ; *b*, shell seen from below, animal nearly in profile ; *c*, anterior part of animal seen from below ; *d*, inside of operculum ; *e*, outside. (*Astrolabe*.)

Recent *Monodontæ* have been found generally on rocks and weeds.

The number of species of *Littorina* given by M. Deshayes in his tables is twenty-four, and ten are recorded as fossil (tertiary). *Littorinæ littorea* and *striata* are noted as found both living and fossil (tertiary).

Littorina occurs also below the chalk. Dr. Fitton, for instance, records seven species in his *Stratigraphical List*. Most of these are from the lower green-sand, but one is from the Portland stone, and another from the Oxford oolite. Mr. Murchison records a species from the Silurian rocks (Caradoc limestone).

Recent *Littorinæ* (the common periwinkle is an example) are generally found on rocks and weeds near and on the shore. *Littorina pulchra* has been found on mangrove-trees fourteen feet above the water. They have also been kept alive six months without water. See the *Zoology of the Astrolabe* for descriptions and figures of many species. [PERIWINKLE.]

Phasianella.

MM. Quoy and Gaimard express their opinion that the *Phasianellæ* are true *Turbines* in all the forms of their organization, and that they ought only to form a division in the genus.

These shells, they observe, once so rare, began to be of less value in consequence of Baudin's voyage, and that of the Astrolabe has rendered them common. The place probably most frequented by them is, according to these zoologists, Port Western in Bass's Strait. They cover the sandy beaches of this vast tract. Each tide carries these mollusks to the shore, where they live high and dry for some hours, and endeavour to withdraw themselves from the heat of the sun by hiding under the *fuci*. Under such shelter they congregate so numerously that seventy-six were found under one of these plants.

The *Phasianellæ*, observe the same zoologists, are always smooth. This polish, and, still more, their continual movements, prevent them from being covered with *Serpulæ*, *Flustræ*, and other parasites which encrust sluggish shells. This agitation makes it difficult for them to preserve the contour of their aperture perfect, for it is very frail. In millions of individuals MM. Quoy and Gaimard always found the lip trenchant, never thick or with a border.

The species appeared to them very difficult to characterise, both with regard to the animal and the shell. The last especially presents so much diversity of colour, and sometimes of form, that one may be deceived, and advance simple varieties to the rank of species. MM. Quoy and Gaimard saw some of these shells, which were brown and greenish during life, become red after death by the solar action, &c.

The most common tint of these mollusks is stated by them to be brown dotted with greenish. This colour is proper to those whose shells are nearly of a similar hue; whilst those which approach white or are speckled with red have the animal of a grass-green.

These are lively active animals, and voracious withal, for they were taken in nets baited with flesh let down into the sea. Their foot, endowed with great mobility, is elongated like a proboscis: its great peculiarity is its faculty of moving in two portions as it were, that is to say, each of its sides advances separately and successively; and a longitudinal gutter may be perceived on its lower surface.

On the coasts of New Holland, the *Phasianellæ* found at King George's Sound are larger and less numerous than at Port Western. They are few in number on the coasts of Van Diemen's Land. The *operculum* is always calcareous.

Example.—*Phasianella bulimoides.*

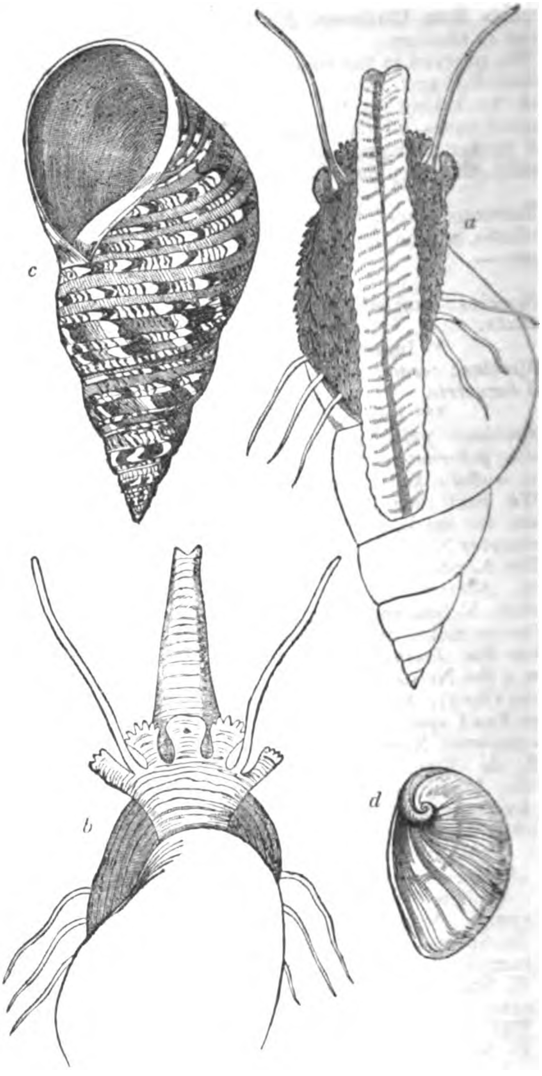
Description.—Shell oblong-conical, smooth, pale yellow, transversely banded; the bands frequent and diversely variegated and spotted; spire acute at the apex.

The animals are generally of a fine green nearly throughout. One will have more white dots on the foot, and another a violet or reddish spot on the lateral fringes of the foot; a third will have this organ yellowish and slightly fringed upon the borders. In all the tentacles are slender and long, the ocular peduncles stout and button-shaped, the palmettes laciniated. The muzzle, which is elongated a little in the form of a proboscis not retractile, can also modify itself into the shape of a rounded scutcheon (écusson). The fringes of the sides of the feet are very finely laciniated, and sometimes present brown ramifications of vessels; they carry three greenish filaments on each side.

The operculum is oval, calcareous, slightly convex, white, and covered for a portion of its contour by a fleshy lamina of the foot which supports it.

Locality.—Very common at Port Western, being the species above alluded to, and larger at King George's Sound. MM. Quoy and Gaimard observe, that Lamarck indicates it as coming from New Zealand: this, they remark, is possible, but they never found any traces of *Phasianellæ* there.

The animals above described came from King George's Sound.



Phasianella bulimoides.

a, animal and shell seen from below; *b*, the same seen from above; *c*, shell; *d*, operculum. (*Astrolabe*.)

The number of species enumerated by M. Deshayes in his tables amounts to nine living and four fossil (tertiary). Of these *Phasianella pullus* is noted as recent and fossil (tertiary).

Phasianella occurs also below the chalk. Dr. Fitton records three species, all from Blackdown, for example.

Here we may notice the genus *Tuba* of Lea, which that acute zoologist thus defines:—

Shell conical, umbilicate; whorls rounded; mouth round; margin not united above; columella thickened and reflected at the base.

'This genus,' says Mr. Lea, 'is nearly allied to *Turbo* and to the RISSOA of Freminville; but not being able, with propriety, to place it with either, I propose to constitute for it a new genus. The reflected margin, which is disposed to be effuse, has at the base some similarity to the *Melaniæ*, and therefore cannot be placed in the genus *Turbo*. It cannot be placed in the genus *Rissoa*, being umbilicated. In eight species of *Rissoa* in my cabinet, all are thickened round the margin, forming a varix. The *Tuba* has no thickening of this kind, the margin being crenulate. The *Rissoa* has an acute apex, while that of the *Tuba* is almost truncate, the superior whorls being smooth and gibbous. Mr. Sowerby's "Mineral Conchology," plate 395, figures a shell (*Turbo sculptus*), which, I think, should be placed in this genus. It is from the London clay of Barton. Of it, and the preceding one, he says, they "do not agree precisely with the character of the genus *Turbo* of Lamarck;" and further, "they form a passage towards *Delphinula*."' Mr. Lea enumerates three species from Claiborne, Alabama (tertiary). (*Contributions to Geology*.)

We proceed to the consideration of the genera *Nerita*, *Navicella*, and *Natica*, which, though they cannot be said to belong to the *Turbinidæ*, especially the last-named genus, which we shall find to be very peculiar, are yet so far analogous to the forms which compose that family, that they may as well find a place here.

Nerita, Linn.

Linnæus placed the genus *Nerita* between *Helix* and *Haliotis*, and he divided the genus into the following sections:—

* Umbilicata.

Species: *canrena*, *glaucina*, *vitellus*, *albumen*, *mammillata*.

** Imperforate, with a toothless lip.

Species: *corona*, *radula*, *cornea*, *fluviatilis*, *littoralis*, and *lacustris*.

*** Imperforate, with a toothed lip.

Species: *pulligera*, *pupa*, *bidens*, *viridis*, *virginea*, *polita*, *peloronta*, *albicila*, *histrio*, *plicata*, *grossa*, *chamæleon*, *undata*, and *exuvia*.

We find then that in the *Systema Naturæ* Linnæus made no marked distinction between the marine and freshwater Nerits.

The *Neritacea* of Lamarck comprise the genera *Navicella*, *Neritina* (Freshwater Nerits), *Nerita* (Marine Nerits), *Natica*, and JANTHINA.

Cuvier makes the *Nerites* (*Nerita*, Linn.) immediately follow the *Janthines*, and includes under them *Natica*, Lam.; the Nerits, properly so called (*Nerita*, Lam.; *Peloronta*, Oken); *Velates*, Montf. (*Nerita perversa*, Gmel., a large fossil species); *Neritina*, Lam. and *Clithon*, Montf. (the crowned Neritines).

M. de Blainville's *Hemicyclostomata*, equivalent to *Nerita*, Linn., comprise the genera *Natica*, *Nerita*, and *Navicella*, or, as he terms it, *Septaria*.

Nerita he divides into the following sections:—

* Right lip toothed. (Genus *Nerita*, Lam.)

A. Species with a single median tooth on the left lip. (Genus *Peloronta*, Oken.)

Example, *Nerita peloronta*.

B. Species with two teeth.

Example, *Nerita exuvia*.

C. Species with three or fourth teeth.

Example, *Nerita lineata*.

** The right lip not toothed. (Genus *Neritina*, Lam.)

D. Species less thick, with the right lip trenchant, and the operculum very oblique. (Genus *Neritina*, Lam.)

Example, *Neritina fluviatilis*.

E. Species whose columellar lip is toothed, and which are provided with spines.

Example, *Nerita corona*.

F. Species with the columellar lip toothed; the two extremities of the right lip prolonged much beyond the aperture, and forming, with the callosity which covers the columellar lip, a sort of auricles produced by the tentacular lobe of the animal.

Example, *Nerita auriculata*.

G. Calyptroïd species, with the upper summit vertical and spired; the last whorl forming the whole base of the shell, and occupied below by a large callosity, which sometimes covers the whole spire. (Genus *Velates*, Montf.)

Example, *Nerita perversa*.

H. Patelloïd species, which are elongated, non-symmetrical, with a dorsal summit, and not spired. (Genus *Pileolus*, Sow.)

Example, *Nerita altavillensis*.

M. de Blainville observes that this genus is formed of marine and fluviatile species, which led Lamarck to subdivide it into two genera, according to the thickness of the shell, which is greatest in the first, and the denticles on the right lip, which are entirely null in the second. M. de Blainville's observations lead him to the conclusion that the species are still more easily distinguished by the sculpture (guillochis) of the external surface of the operculum than by any other character. He remarks that Lamarck enumerates seventeen species of Marine Nerits, which are all from the equatorial and southern seas, and twenty-one River Nerits, or *Neritinæ*, two of which only are European and the others belonging to America and Asia.

M. de Blainville states that only two fossil Nerits are known and two *Pileoli*. But immediately afterwards he says that Defrance reckons five species of fossil Nerits, two of which are analogues (Italy) according to Brocchi; and five species of *Neritinæ*, two from the same country, and four *Pileoli*.

M. Rang adopts the arrangement of M. de Blainville, and condemns Lamarck for generically separating the marine and freshwater Nerits. M. Rang says that there are many species of fossil Nerits.

Mr. Swainson places the family *Naticidæ* between his *Turbidæ* and *Trochidæ*, making it consist of the following subfamilies and genera. His arrangement is, he says, founded on the shells only, from ignorance of the animals of the major part:—

Subfam. 1. Naticinæ. *Sea-Snails.*

Genera: *Natica*, Lam. (with the subgenera *Naticella*, *Globularia*, *Mamillaria*, *Sigaretus*, *Naticaria*, *Lacuna*, *Leucotis*).

Subfam.? Neritinæ. *Nerits.*

Genera: *Nerita*, Linn. (with the subgenus *Neritopsis*, Gray); *Neritina*, Lam. (with the subgenera *Clithon*, *Velotes* (*Velates*), *Pileolus*, and *Navicella*). (*Malacology*.)

Mr. J. E. Gray makes the *Neritidæ* the sixth family of his *Podophthalma*, and places it between the *Fissurellidæ* and the *Ampullariadæ*. Mr. Gray's *Neritidæ* comprise the following genera:—*Nerita*, *Pileolus*, *Culana*, *Neritina*, *Clithon*, *Dostia*, *Velates*, and *Navicella*.

Adanson appears to have been the first to make known the animal of a *Nerita*, and Cuvier afterwards, in his 'Anatomie Comparée,' gave an outline of it: M. de Blainville has added some further details in the zoology of the *Uranie*, from individuals brought home by MM. Quoy and Gaimard, who, in the zoology of the *Astrolabe*, thus follow out those details.

The Nerits are marine or freshwater animals, a modification of habit which MM. Quoy and Gaimard think sufficient for establishing a simple division between these mollusks, which Lamarck erroneously in their opinion separated into two genera—*Nerita* and *Neritina*; for their organization is entirely similar. Thus the *Neritæ*, with a comparatively thick shell, which is very rarely furnished with an epidermis, are always found in the sea; and the *Neritinæ* of Lamarck, whose shell is more delicate and almost constantly covered with an epidermis, are always inhabitants of fresh-water: a single instance of one of these *Neritinæ* having wandered into the sea, they may, they say, perhaps have had to cite. The Nerits have a particular and distinctive appearance: they pass a part of their life out of the water without ever removing to a distance from it. Those which haunt streams or marshes may adhere to the leaves of trees, but without going on land. Those which are found on land are carried there by *Paguri* or by some accident. Marine Nerits are also seen at the mouth of rivers; and MM. Quoy and Gaimard remark that these are transitions which nearly all the mollusks undergo without suffering much.

MM. Quoy and Gaimard state that they were sometimes astonished to see these animals bear, upon the black rocks, all the action of an equatorial sun without appearing to be affected by it. They owe this faculty to providing, when they adhere, some drops of water which sufficiently refresh their branchiæ. This store, or what is left of it, they discharge when they are lifted from the rock.

The Nerits are very widely spread in warm climates. They are gregarious, and many species are found grouped on the same rock. Some love sheltered nooks, others are exposed to the fury of the waves; and, among those which haunt fresh-waters, some live in the deeps in the midst of the strongest currents; others, on the contrary, keep themselves in the slime of marshes. In their sufficiently agile movements their lips are constantly observed in motion.

The animal has a large head, a little notched in front, with two rounded lobes on the sides. The aperture of the mouth, which is subjacent to this sort of hood, is wide and plicated. The tentacles are always very long, pointed, and soft, carrying the eyes at their base upon a pedicle. The foot is oval, narrowed, a little pointed behind, wide in front, with a marginal furrow, and sometimes a depression, which gives it the appearance of being slightly lobated.

The edges of the mantle are fringed, so as to correspond with the internal furrows of the shell. There is no siphon. The pulmonary cavity is proportionally very large; a single, long, triangular, and pointed gill traverses it from left to right. It is free at its extremity. Its lamellæ appeared double to MM. Quoy and Gaimard. The heart is simple, placed backwards and to the left; its ventricle embraces the end of the intestinal loop, which has the appearance of traversing it.

To the right of this cavity, and in the female, is a group of organs worthy of attention. There are seen, first, the extremity of the rectum, and then a very elongated pyriform body, surrounded partially by a sort of gland which is striated transversely, and which opens below. This organ is hollow, and contains within its cavity, coadapted to each other, many bodies in an elongated mass, terminating in filaments. They are of a resisting substance, fibrous as it were, and appear granulated under a magnifying lens. The particular use of this little apparatus MM. Quoy and Gaimard cannot divine, but they think it doubtless fulfils some functions relative to generation, for it is only found in females. More externally is the uterus, composed of a pyriform pouch, and of a *renflement* which is coadapted to it, which contained a great quantity of round, white, and cretaceous eggs. The large, long, and tortuous oviduct causes this organ to communicate with the ovary, which is placed at the right border of the liver.

In the male the testicle occupies the same place. The deferent canal is knotted upon it; it is a thread, which in water may be unravelled to the length of two feet. It becomes stouter at its termination, which MM. Quoy and Gaimard traced to the exciting organ, which last is short, and placed at the base of the right tentacle.

The mouth, of which something has been already said, is an oval mass, sustained by two small articulated cartilages, and covered with muscles. Above is inserted a rather long riband with five rows of hooks. The œsophagus is slender, as well as the stomach, which is hardly distinguishable from the rest of the intestinal canal. This last, after having passed into the liver, returns to the buccal enlargement, thus describing a great circle, and touches the heart, which is applied upon it at the base of the gill, and terminates by the rectum. Two great salivary glands, which are flat and granulated, and shortly pediculated, repose upon the œsophagus without adhering to it. Their duct passes under the brain. The liver appears to be formed of a single mass describing an elbow-like figure (coude), from left to right, and lodging in a cavity of the shell, the commencement of the spire, which returns forward and is placed under the dentilations of the aperture of the shell.

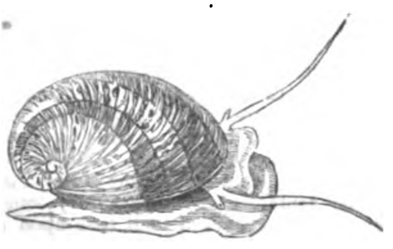
The cerebral ganglion forms a triangular loop in which the œsophagus passes. The branches unite below in two small ganglions, which touch each other. From it are given off nervous filaments for the different parts of the body. (*Astrolabe*).

Example.—*Nerita polita.*

Description.—Shell thick, smooth, somewhat shining, longitudinally striated very finely, varying in colour; the spire very retuse, the lip toothed, smooth above. (Lam.)

This species, according to MM. Quoy and Gaimard, is the most plentifully diffused of any of the genus, and is found in nearly all the seas of warm climates. It is heavy, polished, marbled, and often coloured with three red transverse bands.

The animal is of a uniform yellowish white, with the exception of the tentacles, which are of a smoky-brown colour.



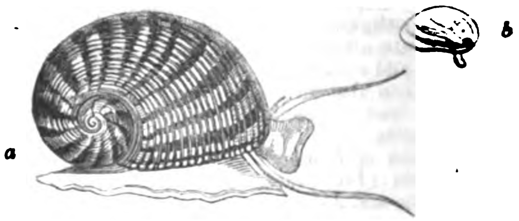
Nerita polita, with its animal. (*Astrolabe.*)

Nerita Ascensionis. Shell solid, transversely furrowedly ribbed, greenish-grey, spotted with white and brown; spire prominent, the apex yellow; aperture white; the lip toothed, rugous above; marked above with a yellow spot. (Lam.)

This shell is deeply striated, rugous, yellowish-grey, with circumscribed brown spots upon the parts in relief; aperture smooth, yellowish-white; peristome dotted with white and brown.

The animal has the foot yellow below, striated and dotted with deep brown on the sides, so as to appear nearly black on a yellowish ground. The head, which has a very expanded hood, is striated in the same manner. The neck is violet. The tentacles are long, pointed, lively-brown, striated longitudinally with black. The eyes, placed at their base, are at the extremity of a triangular *palette* of yellowish-white, having a black stripe at the external border. The mantle has its contour dotted with brown. The operculum is red-brown, very much granulated, angular at the posterior border, and provided with a very projecting heel or process.

Locality.—The Island of Ascension. (*Astrolabe.*)



Nerita Ascensionis.
a, shell with animal; *b*, operculum.

Nerita (*Neritina*) *pulligera.*

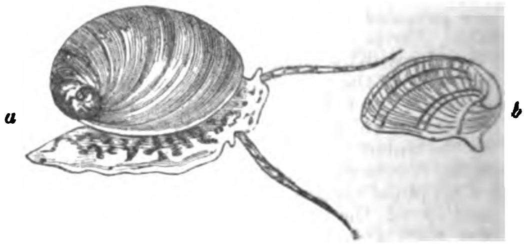
Description.—Shell ovate, slightly striated, blackish-brown; the outer lip dilated, thin, white within, the margin acute, the inner border yellowish; the inner lip toothed. (Lam.)

This fine species is uniform chestnut, with the striæ of growth strongly marked; these converge on the spire, which is covered by the right lip.

The animal has long delicate tentacles, which are yellowish soiled with brown. The head and sides of the foot are yellow, spotted with brown and black. The under part of the foot is reddish.

The operculum is large, of an apple-green colour, with black transverse bands proceeding to converge towards the spire: its contour has a reddish line. (*Astrolabe.*)

The drawing from which MM. Quoy and Gaimard have figured this species was made at Umata in the island of Guam. They state that there are also *Nertiæ pulligeræ* at Vanikoro. They found on the trees dead shells whose spire was always corroded, and they inquire whether they had been brought there, or whether the animal had died after having ascended the trees. They state as a remarkable fact, that in a great number of individuals of this species they found in the liver a small knot of worms, some of which were not less than seventeen lines in length. They were pointed at both ends, like *Lumbrici*, or Round worms.



Nerita (Neritina) pulligera.
a, shell and animal; *b*, operculum.

The number of species of *Nerita* recorded by M. Deshayes in his tables is 18 living and 16 fossil (tertiary). The genus is noted in the list of Red Sea fossil shells above alluded to. It occurs also below the chalk. Dr. Fitton, in his Stratigraphical Table, notices two species with a ? from the Portland stone, and Mr. Murchison records one, positively, from the Silurian rocks (Wenlock limestone and Wenlock shale).

The number of species of *Neritina* noticed by M. Deshayes is 66 living and 17 fossil (tertiary); of these *N. fluviatilis* is recorded as both living and fossil (tertiary).

Mr. Broderip has described four living species, and Mr. Sowerby the same number, brought to this country by Mr. H. Cuming, which can hardly have been included in the numbers stated by M. Deshayes. *Neritina* is found below the chalk: example, *Neritina Fittonii* (Hastings sand).

Navicella.

With the exception of the disposition of its operculum and of the muscles of attachment to the shell, the animal may be said to be nearly similar to that of *Nerita*. Its head is large, convex, notched, a little auriculated anteriorly, carrying two long and very pointed tentacles, having the eyes at their base, on a rather elongated pedicle. The foot is regularly oval, and does not overborder the shell: at its union with the mantle, near its root, it presents a remarkable *bourrelet*, which is due to the internal disposition of the operculum. It is pale-yellow below, deeper upon the sides, with spots of deep-brown, as is the case with the head and the ocular peduncles; only the tentacles have a smoked colour, with black and very delicate longitudinal striæ. Mantle light yellow.

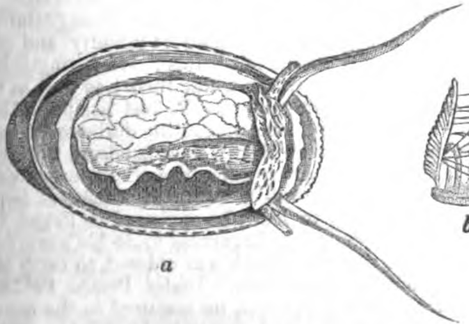
The semi-septum which completes the posterior part of the shell seems, in the living subject, rather formed by a fibrous substance of a nacreous-yellow, than a calcareous deposit.

After having raised the shell, the first remarkable object is the disposition, a little in the form of the letter S, of the muscles of attachment on each side; their whiteness is striking, contrasted as they are with the sombre colour of the mantle, which forms the pulmonary cavity. This last is very ample, and contains a single triangular gill, which is slightly prismatic, free at its extremity, retained at its base by two lateral membranes, and placed less obliquely than that of the Nerits. The heart envelopes the rectum by its ventricle.

Four cartilaginous pieces compose the ovoid buccal mass, which the retractor and protractor muscles set in motion. The lingual riband is long and furnished with seven rows of hooks. The œsophagus has, at its origin, two long salivary glands. The stomach is hardly distinct from the digestive tube, which describes a great loop, as in the Nerits. In the male, the deferent canal describes endless circumvolutions, which one may easily unroll. This very delicate body is of another length than it is in the Nerits—many feet, as MM. Quoy and Gaimard believe. The exciting organ, placed at the base and in front of the right tentacle, is short, large, slightly curved, and furnished with a small hook. It is always projecting. The orange-coloured testicle is coadapted to the liver, and occupies the extremity of the spire. The liver is covered with white vascular ramifications.

In the female, the uterus opens on the same line as the anus and at its internal part. MM. Quoy and Gaimard did not remark the singular apparatus described in the Nerits. A furrow only leads from the uterus to the extremity of the foot. They say that they have found it in many female mollusks, and it should serve, they think, for conducting the eggs to their exit. The whole of the visceral mass is only separated from the operculum by an excessively delicate skin. MM. Quoy and Gaimard then quote the following observations of M. de Blainville:—

The form and especially the position of the operculum of *Navicella* are so anormal, that it may be said that it is not a true operculum, and that it is situated in the foot. But it is an evident operculum, and its place is, as in all the cephalous mollusks which are provided with that organ, above the foot: its form is subquadrilateral; it is adherent throughout its lower surface, free on its upper surface, and terminated behind by a cartilaginous part, by means of which it increases. It is carried, as in the *Naticæ*, by a very small appendage of the foot, which overborders it a little behind. But that which renders it so anormal is, that the foot, which is really subtrachelian, that is, only attached below the body, is united, nearly throughout the rest of its length, to the visceral mass by the continuation of the skin which envelops it; whence it results that the operculum seems to be contained in a sort of pouch situated between the foot and the viscera, and whose aperture, in the form of a transversal slit, is at the posterior extremity of the body. This disposition of the operculum of the *Navicella*, says M. de Blainville, prevents it from really serving the ordinary purpose of one.



Navicella elliptica.

a, Animal in the shell seen from below; *b*, operculum.

Example, *Navicella elliptica*.

Description.—Shell ovate elliptical; subepidermis greenish-brown, smooth, shining, squamously spotted with white and cerulean; the apex recurved, subprominulate beyond the margin. (Lam.)

The number of species of *Navicella* recorded by M. Deshayes in his tables is two living: no fossil species are mentioned. M. de Blainville gives three as the number of recent species (fluviatile), and these from the Indian Archipelago.

Natica.

MM. Quoy and Gaimard remark, that the *Naticæ* are animals to which their foot gives a remarkable aspect. It is a long oval lamella, ordinarily squared in front, oval behind, and doubled. Anteriorly, where it is widest, it is a thick escutcheon, a little auriculated, which ascends on the front of the shell, which it covers, at the same time that it hides all the head of the animal, of which ordinarily nothing but the tentacles appear. A groove on each side indicates the two parts of the foot.

The posterior escutcheon, which is less considerable, supports the operculum, which it overborders in order to cover the left lip and the extremity of the shell. There are individuals in which it has the same size as the foot, from which it is distinguished by a circular groove. Thus, observe these zoologists, throughout their development the *Naticæ* resemble a mass of flesh, on the summit of which one perceives a part of the shell. The operculum, although very large, is not apparent; placed transversely, it is hidden by the extremity of the shell, which contains the mass of viscera. A very small muscle binds all this development of flesh to a rather slight columella. The rest of the animal, which is but slightly spiral, offers nothing remarkable.

The head is large; the tentacles very distant, flattened, long, and pointed: MM. Quoy and Gaimard did not detect any eyes. The final cause is here, they observe, perceptible: what purpose could they have served when always hidden by the anterior scutcheon, which meets the border of the mantle, which is without a siphon? The respiratory cavity is small. It carries on the left two unequal gills as ordinarily. The greatest has large triangular lamellæ free in a portion of their extent. The heart is ovoid, with a single auricle and a single ventricle. The rectum and the uterus are placed on the right side of the cavity. In the male the exciting organ is very large, triangular, channelled on its right border, and placed very near the right tentacle. The aperture of the mouth is deeply hidden behind the hood which forms the head. A small very short proboscis, two horny-plates surmounted by a very small lingual riband, which is hooked, form a small oval button, behind which open the two ducts of the two small salivary glands. All these parts have a retractor muscle. The œsophagus is long, slender, preceding a globular stomach, occupying alone the whole abdominal space: the intestine, which is delicate, passes upon the liver and terminates by the rectum without circumvolutions.

The liver and the testicle are grouped together. The deferent canal of this last is not long. In the female the ovary touches the uterus, which is very voluminous.

MM. Quoy and Gaimard remark, that one would hardly believe, on looking at the small capacity of the shell and the extent of the locomotive parts, that they could all re-enter into the shell and be made to disappear completely. This however is done, slowly it is true, and then the operculum entirely closes the aperture. But this seems to cost the animal some effort, for they remarked that it rarely developed itself twice. The operculum is oval, paucispiral, and represents the arc of a circle. It is membranous or calcareous: the latter appeared nearly always to belong to those *Naticæ* whose umbilical fissure is to the right of a callous columella; for those which have this fissure to the left of that callosity have most frequently a horny operculum. MM. Quoy and Gaimard know of one exception only to this rule.

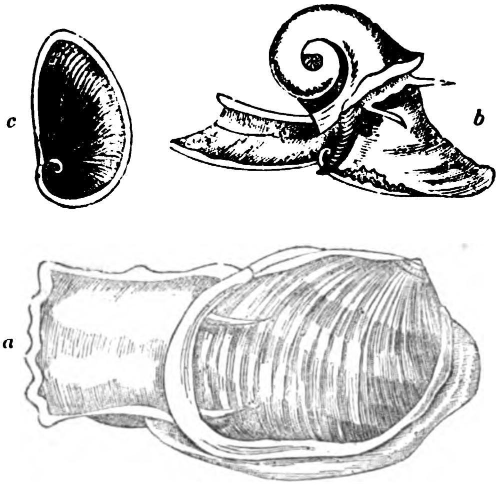
The *Naticæ* are vivacious; and MM. Quoy and Gaimard observe that the examination of their viscera indicates that their nourishment must consist of substances already attenuated. All seas, they remark, furnish *Naticæ*, which are however most widely distributed in warm climates. Nevertheless, they add, from the fragments found on the beaches, New Holland must possess as great a number as many countries nearer the equator. Some species, they state, have an epidermis, and, perhaps, all. (*Astrolabe.*)

Example.—*Natica melanostoma.*

Description.—Shell oval, ventricose, convex-depressed, thin, white, zoned with yellow; spire somewhat prominent; lip blackish-brown, umbilicus semi-closed. (Lam.) Length 15 lines, breadth 11¼ lines.

Operculum membranous; paucispiral on the left border; the rest of its lamellæ obliquely transverse. Colour deep chestnut brown, lighter on the edge.

Locality.—Tonga, the Moluccas, and many other places.



Natica melanostoma.

a, shell with animal seen from above; *b*, animal out of the shell; *c*, operculum.

Found by MM. Quoy and Gaimard some fathoms deep Species of the genus have been captured creeping on the shore like the Nerits on rocks and sea-weed, and from the surface to the depth of forty fathoms on mud and sandy mud, in æstuaries and in tidal rivers.

Mr. J. E. Gray makes the *Naticidæ* the first family of his second section, *Eriophthalma* (Edriopthalma?), of his second order, *Phytophaga*. Under the *Naticidæ* he comprises the following genera:—*Natica, Neverita, Nacca, Cepatia, Polinices, Mammilla, Cernina, Globulus, Naticina, Cryptostoma, Stylina? Radula?* and *Neritopsis*.

The number of species of *Natica* recorded by M. Deshayes in his Tables is 56 living and 41 fossil (tertiary): of these *Naticæ millepunctata, Guillemeni, canrena, Valenciennesii, Dilwynnii, glaucina, monilifera, mamilla*, and *zebra* are noted as recent and fossil (tertiary). In addition to these, *Naticæ melanostoma, mamillaris, Græca*, and *alba* occur in the list of Red Sea fossils above alluded to, collected by Mr. James Burton, communicated to Mr. Lyell by Mr. Greenough, and named by Mr. J. E. Gray and Mr. Frembley.

Natica occurs in the tertiary of Alabama. Mr. Lea describes eight species from the Claiborne beds, and remarks that the genus is widely spread through the various strata from the inferior oolite to the crag in Great Britain, where nearly twenty species have been observed. Twelve of these have been found in and about London. Those mentioned by M. Deshayes appear to be well distributed through the Pliocene, Miocene, and Eocene periods of Lyell. In America casts have also been found in the cretaceous group of New Jersey by Dr. Morton, and four species have been described from the tertiary of Maryland by Messrs. Say and Conrad. (*Contributions to Geology.*)

Dr. Fitton records five species from the strata below the chalk—upper green-sand, gault, lower green-sand, and Blackdown; and Mr. Murchison two from the Silurian rocks—old red sandstone (middle and lower beds only), upper Ludlow rock, Aymestry limestone, and lower Ludlow rock.

TURBINO'LIA. [MADREPHYLLIÆA.]

TURBINOLOPSIS. [MADREPHYLLIÆA.]

TURBO. [TURBINIDÆ.]

TURBOT. [PLEURONECTIDÆ.]

TURDIDÆ. [MERULIDÆ; THRUSHES.]

TURDUS. [MERULIDÆ; THRUSHES.]

TURENNE, HENRI, VICOMTE DE, second son of Henri duc de Bouillon and of Elizabeth of Nassau, was born on the 11th of September, 1611. His constitution showed symptoms of weakness till he attained his twelfth year. His imagination however had been inflamed by the perusal of the lives of celebrated warriors, and perhaps by the conversation at his father's court, before he was ten years of age; and it is possible that the opposition at first offered to his embracing arms as a profession on account of his indifferent health may have confirmed his wish to become a soldier. The duc de Bouillon was one of the ablest soldiers bred in the school of Henri IV.; his high rank, love of letters, attachment to the Calvinistic faith, and abilities as a statesman, raised him to be the leader of the Huguenot party after the death of that prince; and his position as sovereign of the small state of Sedan opened a range to his ambitious views, and lent to his character a tone of independence which he could not have acquired as a mere peer of France. The spirit instilled into the young mind of Turenne in a court which took its character from such a prince was, even from the first, more the ambition of the statesman and scientific commander than the imaginative chivalry which inspires most boys. He learned slowly and with difficulty; he rebelled against punishment and constraint; but when his ambition was appealed to, he made dogged perseverance a substitute for quick apprehension. His moral character was developed under the control of Tilenus, a moderate Calvinist, by whom he was confirmed in a natural benevolence and sincerity of disposition, and accustomed to subject his naturally strong and excitable passions to the dictates of reason by his still more powerful will. He evinced a taste for athletic exercises, which contributed materially to strengthen his naturally weak constitution.

The duc de Bouillon died in 1623; but the system of education he had adopted for the young Turenne was persevered in by his widow. Jealousy of the designs supposed to be entertained by Cardinal Richelieu to the prejudice of the Huguenots induced this lady to send Turenne, in 1625, to Holland, to the charge of his uncle Prince Maurice. This statesman and warrior soon detected a large fund of good sense beneath the nowise showy exterior of his nephew, and exerted himself to cultivate the lad's natural talents. He made him commence his apprenticeship to the art of war by carrying a musket as a volunteer, and rendering himself practically familiar with the duties of the private soldier and subaltern officer. Three months after the arrival of Turenne in Holland, Prince Maurice died; but his brother Henry Frederic, who succeeded to his high office, was equally attentive to their young relative. In 1626 Turenne obtained a company of infantry, and continued to serve under his uncle till 1630. He distinguished himself by anxiety to learn the whole theory as well as the practice of war. His company was the best disciplined and accoutred in the army; his own routine duties were performed with unfailing regularity; and his leisure time was spent in taking part in every enterprise where experience was to be acquired. He was naturally of a fearless disposition: in his anxiety to learn he appeared to forget the very existence of danger. Eagerness to do his work thoroughly was apt, when an attack was ordered, to carry him beyond the bounds of prudence. Under Prince Frederic Henry, and opposed to Spinola, he acquired in the course of six years an intimate and extensive knowledge of the kind of war at that time carried on in Holland—a succession of sieges.

In 1630 Richelieu contemplated placing a French garrison in the town of Sedan, and the only means by which the dowager duchess of Bouillon could avert so dangerous a step for the independent sovereignty of the young duke, yet a minor, was by sending a hostage to the French court. For this purpose her younger son was sent to Paris. Turenne, whose reputation had preceded him, was received with open arms at court, and though only nineteen, appointed to the command of a regiment of infantry. His history for the next four years is a blank. The first opportunity he had of distinguishing himself after entering the service of France was at the siege of La Motte in 1634: his conduct on that occasion procured for him, in his twenty-third year, the appointment of maréchal-du-camp, then the next in rank to that of maréchal de France.

In 1635 the Cardinal de Richelieu sent four armies into the field to attack the Spaniards simultaneously on as many different points. One under Châtillon and de Brézé marched into the Low Countries; the Maréchal de Créqui led another into the Milanese; the Duc de Rohan a third into the Valteline; the Cardinal de la Valette was placed at the head of the forces destined to co-operate with the Swedes in Germany, and Turenne was attached to him as maréchal-du-camp. La Valette joined the duke of Weimar at Bingen on the Rhine in August, and the combined forces forced Mansfeld to raise the siege of Mayence. The Imperial general Galas contrived, by a movement from Worms, to cut off their communication with France, and the allied forces, stationed in a country exhausted by war, were thus exposed to famine. Turenne sold his plate to procure provisions for the soldiers under his immediate command. In the disastrous retreat that ensued, while discipline was almost entirely lost and the baggage thrown away by the rest of the army, he retained his troops in their accustomed order, abandoned only so much of the baggage as enabled him to procure waggons for those who were unable to march, and by mixing familiarly with the soldiers and sharing his provisions with them kept up their spirits. The duty of protecting the rear devolved mainly upon him, and in the discharge of this arduous task he had occasion to show how he had profited by his education in Holland, in the art of seizing upon defensible posts and maintaining them as long as might be necessary. The disasters of this campaign indisposed La Valette to undertake the command of that projected for the countries on the Upper Rhine in 1636, and Richelieu only overcame his reluctance by consenting that Turenne should again accompany him. The success which attended this division of the French forces, while those on the frontiers of the Netherlands were less fortunate, induced Richelieu in 1637 to give the command of the army against Flanders to La Valette, who again insisted upon having Turenne for one of his maréchaux-du-camp. This was a campaign of sieges, and the conducting of them devolved almost exclusively upon Turenne. With infinite difficulty he took Landrécies; obliged Solre, with a garrison of two thousand men, to surrender at discretion in a few hours; defended Maubeuge successfully against the Cardinal Infant; and being intrusted with the pursuit of the retreating enemy, closed the campaign by driving the Spaniards across the Sambre. In 1638 Richelieu sent two reinforcements to the duke of Weimar on the Upper Rhine, under Turenne and Guébriant, who were designated lieutenants-general, the first of that title in France. After the death of the duke of Weimar in 1639, Turenne returned to Paris. Richelieu wished to marry the viscount to one of his relations; but Turenne, who foresaw difficulties that might arise on the score of religion, frankly, but respectfully declined the alliance. He was soon after sent to Italy, second in command to the Comte d'Harcourt. In 1640 the French commander adopted the advice of Turenne in opposition to all the rest of his generals, and formed the siege of Turin. He sat down before the city on the 10th of May, and it held out till the 17th of September. The garrison amounted to twelve thousand men, and the enemy were in force in the neighbourhood; but Turenne calculated upon the moral effects of the surrender of the town. He was employed to cover the siege with a strong detachment from the army, a task which he discharged successfully. Still the attack would have been abandoned, but for the excellence of his arrangements for supplying the besieging camp with provisions. After the surrender of Turin, D'Harcourt returned to France, leaving the army under the command of Turenne. The relations in which his brother the Duc de Bouillon stood to the court rendered it unadvisable in the eyes of the minister to intrust Turenne with an army, and D'Harcourt was ordered in 1641 to resume the command. During the remainder of the reign of Louis XIII. the political conduct of the Duc de Bouillon kept Turenne in the background. One of the first acts of Anne of Austria as regent was to send him letters patent appointing him general of the armies of the king in Italy.

Italy was not however destined to be the scene of his exploits as a commander-in-chief. The Duc de Bouillon, who had reconciled himself to the new court, soon quarrelled with it, as with the old, and took refuge at Rome. Mazarin thought it unsafe to leave the brother of this disaffected prince in command of an army so near him, and ordered Turenne to repair to Germany and re-organise the army which, originally raised by the duke of Weimar, had again been left without a leader through the death of Guébriant and capture of Rantzau by the Imperialists. Turenne took the command of this collection of soldiers of fortune without a country, most of them Germans by birth, in December, 1643, and retained it till after the conclusion of the peace of Westphalia in October, 1648. During the winter 1643-44 he succeeded, by the most strenuous exertions, and by raising money on his own credit, in re-equipping his army and restoring its discipline. He gave an army to the king, instead of receiving the command of one from him. And in the last year preceding the peace of Westphalia it was his judgment and decision that restored this same army to France, after it was on its march to join the enemy on the allegation that the French government had broke faith with it, at a time when he could only pay the mutinous soldiers one month out of a six months' arrear. Yet with such an army, so great was his power of conciliating the affections and keeping up the spirits of the soldiery, he struggled through five campaigns, against leaders of no ordinary ability, to a complete triumph. In conjunction with Condé he kept head against the Imperialists, flushed with recent success in 1644. In 1645 he prevented the bad effects of the defeat at Mariendal, incurred through the misconduct of Rosen, by his splendid retreat; and concluded the campaign by reinstating the elector of Trèves in the possession of his territories. In 1647 he put an end to the mischievous custom of separate and independent action on the part of the allied armies of France and Sweden, and commenced the system of combined operations which led in the course of that and the succeeding campaign to the occupation of the Bavarian territory and the emperor's consent to the treaty of Münster.

The peace of Westphalia, which released France from foreign wars, was the signal for the commencement of civil broils. In the commencement of 1649 the regent and cardinal left Paris with the king, and the prince of Condé commenced a blockade of the city. The duc de Bouillon embraced the party of the Fronde. Turenne was at this time stationed with his army on the frontiers of Germany. Wholly engrossed with his military duties, he had hitherto taken no part in politics. The Huguenots, among whose party he had been bred and educated, were opposed to the court. He was not a subject of France; his allegiance to that crown could be dissolved at any time by resigning his commission. Thus situated he rejected the overtures of Mazarin, telling him that the blockade of Paris during a minority appeared to be an unwarrantable stretch of power, and he endeavoured to persuade his officers to take part against the Cardinal. The court however had gained so many regiments that he soon saw the attempt was vain, and retired to Holland with some of his personal friends. A hollow truce was soon after arranged between the contending factions, and Turenne returned to France. A quarrel between Condé and Mazarin led, after numerous petty intrigues, to the arrest of the former. Condé had not long before reconciled himself with the duc de Bouillon and his brother: Turenne was faithful to the prince in adversity. He threw himself into Stenai, and prevented its being taken by the royal troops. He alone rallied the dispirited friends of Condé, and, by calling the Spaniards across the frontiers, procured the release of the prince, the exile of Mazarin, and the conclusion of a peace with Spain.

Turenne returned to Paris in May, 1651. The court offered him favours and advancement; the Prince of Condé sought to enlist him in his party. He intimated to the former that he desired no preferment; to the latter, that having accomplished his release from prison, his duty towards him was fully discharged. A less penetrating mind than Turenne's could have discovered that a Huguenot party existed only in name; that the Fronde was an incongruous association of unprincipled intriguers, each of whom sought only his personal aggrandisement; that the age of petty independent sovereignties such as existed in his house had passed; and that the only career of honourable ambition open to him must be sought by becoming a French subject, attaching himself to the only minister capable of organising a strong government in France. With characteristic absence of display or precipitation he declared for the regent and Mazarin, and accepted in 1652 the command of the royal army. It was soon evident that the same mind which alone upheld the Prince of Condé's cause when he was imprisoned, now struggled to uphold the royal authority, against apparently as fearful odds. The Cardinal Mazarin, the object of popular execration, was again with the court, and all France seemed to unite against the prince. The king had to oppose one army to the Spaniards in Catalonia and another in Flanders; and only 9000 or 10,000 men could be mustered to oppose the rebel nobles. The favouritism of the court, even at so anxious a moment, offered to Turenne the insult of proposing to divide the command between him and Hacquecourt, an officer ten years his junior. Knowing that time must do him justice, he complied with the unreasonable request. But his genius maintained its ascendant, and the plan and execution of the campaign were really his. By the close of the year Condé was obliged to quit France: the king was crowned at Rheims, entered Paris, and consigned the Cardinal de Retz, the only remnant of the Fronde, to a dungeon.

From 1653 till the conclusion of the year 1659, Turenne's genius for war found ample scope in the wars of the French and Austrian Netherlands. During the whole of this protracted struggle he had to contend against the Prince of Condé, the most brilliant military genius of his age. It was on the part of Turenne intense but regulated energy, sound judgment and sleepless observation, opposed to an almost miraculous quickness of perception on the part of his adversary, and an impetuosity of execution, to which an ardent imagination would have lent irresistible force could the effort have been made continuous. The treaty of the Pyrenees put an end to a struggle more persevering and destructive than any that Europe had previously witnessed, and yet indicative of that growing equality of European states, the full sense of which can alone guarantee permanent peace.

The death of Mazarin in 1661, and the resolution of Louis XIV. to be thenceforth his own prime minister, though it did not raise Turenne to office, gave him a powerful influence in state affairs. He had from the time he embraced the cause of the Prince of Condé necessarily had a political character, but so long as Mazarin lived he was contented to leave it to contribute indirectly to its promotion. Almost the only occasion in which he appears to have laid aside this passive character was in the negotiations he commenced with Monk after the death of Cromwell. But his advice was sought and valued by the monarch who boasted that he was his own prime minister. The first sensible effect of the influence of Turenne was the resolution of Louis to protect the independence of Portugal, which Mazarin had made up his mind to sacrifice to the Spaniards. Turenne's credit with De Witt was mainly instrumental in opening the negotiations with Holland which led to the treaty of commerce concluded with that power. The instructions of the Count d'Estrades, who negotiated the treaty, were drawn up by Turenne. When, in 1665, England and Holland each endeavoured to induce Louis XIV. to assist in the war against the other, it was by the advice of Turenne that the king endeavoured to reconcile the belligerents.

Turenne had married, in 1653, Charlotte, only daughter and heiress of the Duc de la Force, a zealous Protestant. Regard for his wife's feelings appears to have kept him longer in the Protestant communion than his own inclinations. The French Protestants had allowed themselves to be made the instruments of political factions; and this circumstance, which had made Sully withdraw from their councils, kept Turenne from entering them. He had been educated by a moderate Calvinist, and, like most active men who seek not a religion of abstract opinions, but of practical influence, he cared little for doctrinal points. The fierce controversies of the Calvinists and Arminians disgusted him; and the numberless sects which sprung up in Holland and England confused him. Perusing the controversies of the Jansenists and Jesuits, he found the very same controversy that shook the Reformed church agitating the Roman Catholic, and thus learned to look upon the difference between the two churches as merely formal. The conversation of prelates like the bishop of Meaux, and the silent influence of the conventional tone of the circles in which he moved, all contributed to sap his Protestantism. And although Turenne's mind would have revolted (had revolted in earlier life) from the idea of changing his religion to advance his fortune, the feeling that it kept him in some sort an alien in the court of which he was one of the brightest ornaments could not fail insensibly to influence his mind when he had brought himself to view the difference between the sects as not essential. The death of the viscountess in 1666 removed the last tie that bound him to the Protestants; and he was received into the bosom of the Roman Catholic church by the archbishop of Paris. This transaction was privately conducted; the change of his creed could not raise Turenne higher in the state than he already stood; his confidential letters for years previous show that his mind was in a state to be easily determined to such a step: his whole subsequent conduct indicates sincerity in his adopted faith. His change of religion cannot be called a conversion in the high sense of the word; but there was nothing dishonourable in it: it was merely an additional step in the process of changing the son of the independent sovereign of Sedan into a thoroughly naturalized Frenchman.

Although circumstances had obliged France to join the side of the Dutch in their war against England, France took scarcely any active part in the contest, and promoted the peace concluded between the belligerents in 1667. Louis availed himself of the peace to form a combination against Spain, with a view to make himself master of the Spanish Netherlands. The campaign in Flanders, in which Louis told Turenne he wished to learn the art of war under him, was the consequence. The fears entertained by England and by the partisans of the House of Orange in Holland, of the consequences of French aggrandisement on this side led to the last war of Turenne. The narrative of this war, which commenced in 1672, belongs to history rather than to biography, which confines itself to the illustration of individual character, at least in a sketch like the present, in which the subject is presented merely in outline. The victories gained by Turenne from the year 1672 to the year 1675 serve only, so far as he is concerned, to place in a more brilliant light the qualities which he had amply displayed on former occasions. These victories served to impress Louis XIV., who gained by them, with the vain idea that he was invincible; but they taught William of Orange, who suffered by them, to act in future years as became one who really was the scholar of Turenne. In Montecuculi Turenne found an opponent worthy of him, one who, like himself, had passed through every grade of service. The premature death of the vicomte prevented either from claiming a personal advantage over the other. Henri, Vicomte de Turenne, fell near Sassbach, on the 26th of July, 1675, while preparing to lead his troops into action. The French soldiers cried, 'Our father is dead;' the hostile general declared that a man had fallen who did honour to human nature; and the surviving French leaders, although their troops were marshalled for battle, retired without hazarding an action. The letters of Madame de Sevigné present a lively picture of the effect produced on the public mind at Paris by the intelligence of Turenne's death.

Turenne's victories, his state papers (published by Ramsay at the end of his Memoirs), and his private letters, all bear the impress of a truly great mind. In him clear and comprehensive views were combined with energy in action: both in politics and religion he was superior to the harsh and narrow feelings of the partisan; and his domestic life was eminently pure.

TURF, the sod which covers the surface of pastures, and is composed of a portion of the soil with the roots of natural grasses or other plants; which gives the whole a consistence, and allows of its being raised in slices by the plough or the pareing tool made for the purpose.

The word is often also applied to the substance which is generally called *peat;* and when the latter is taken from the surface where living plants are growing, the name of turf is very applicable to it. It is derived from the Dutch word *torf*, which is generally applied to perfect peat as well as to turf. The origin and composition of peat have been described in its proper place. [Peat.] We shall only here notice the uses to which turf is applied, when we mean a sod taken from the surface on which some living plants are still growing, or have lately done so. Near extensive heaths which have never been reclaimed, and in situations where no regular peat-bogs are to be found, turf becomes a very useful fuel. It is pared off the surface with the heath growing on it, in dry weather, in sods of a convenient size, generally round and about one foot in diameter. The thickness of the sod depends on the depth and abundance of the roots found in it, as they are the sole cause of the turf continuing to burn when the blaze caused by the burning of the heath is over. As the soil of the places where turf is usually cut is generally of a sandy nature, turf ashes are not so valuable for manuring the land as peat ashes: still they contain portions of potash and other vegetable salts, and produce a very good effect when spread as a top-dressing on moist meadows the soil of which is chiefly composed of clay. In sufficient quantities they are excellent to raise turnips; and it is generally observed, that where poor heathy pastures are pared for the purpose of burning the turf on the spot and spreading the ashes, the turnips sown there seldom fail. For the advantages and disadvantages of this operation, see Paring and Burning.

Where the poor can readily obtain turf for the trouble of cutting it and drying it for use, a degree of comfort is diffused through their cottages which cannot be found where fuel is scarce. In the large open chimney the whole family can be seated by a pile of turf burning on the hearth.

Turf is used for many other purposes, as well as for fuel: laid like tiles on a roof overlapping each other, they form an excellent and cheap protection against rain; cut somewhat thicker, and in the shape of bricks, they serve to build the walls of cabins, which are warm and durable, provided the eaves of the roof project sufficiently to cover them. The soldier who has served through many campaigns knows from experience that a conical hut of turf can be raised in a very short time, if the material is at hand.

When clay is burnt to improve the texture of the soil, the operation is best performed in a circular hearth made of turf, with certain flues to regulate the supply of air to the burning mass. The turf is a slow conductor of heat, and by its means the mass is kept burning steadily in the interior of the heap, without being cooled by the effect of the external air. When the turf-wall itself begins to burn through, it is generally the proper time to mix the whole and extinguish the fire.

The turf which we have been considering is taken from the surface of uncultivated land, and in the course of a certain number of years the wild heaths and other plants natural to the soil spring up again, and by their stems and roots produce a fresh turf; to assist this renovation it is usual to cut the flat turves of a circular shape with a thin paring tool as we observed before, so that there remain portions of the surface which are not disturbed, and from which the heath and wild plants soon spread over the surface which has been cut. In this way the same spot may be made to give a fresh supply of turves every seven years. This is only done where the soil is absolutely barren, and where its cultivation is not thought of: for at last every remnant of good earth is carried off, the grasses disappear entirely, and nothing but the common heaths can find food for their vegetation.

The surface of good pastures, especially of commons, is often pared for the purpose of forming an artificial turf for ornament or for the purposes of pasture. In the first case those spots are chosen where the grass is of the finest and closest pile. The surface is pared as thin as can conveniently be done, so that the sward shall not break. A proper spot having been chosen, it is divided by the spade, or some sharp instrument like a knife stuck across a long handle, into strips about a foot wide; and a very sharp flat instrument with a bent handle, so as to work horizontally, is thrust an inch, or a little more, below the surface, paring off the strip which has been marked. As the workman who cuts the sod advances, another rolls it up before him, until it is of a proper size to be carried off. A cut is then made across the strip, and another roll is begun. Thus a large space may be completely bared, or parallel strips may be cut out, leaving some of the turf uncut between them. In this case the loss of the herbage will be soonest repaired by the spreading of the grasses from the strips which are left. When an ornamental lawn is to be formed by laying down the turf, the ground is levelled, or laid in any desired form. It is well rolled and beaten, to make it firm, and if the weather is dry, it is well watered before the turf is applied. As lawns require frequent mowing, a close, slow-growing turf is a great advantage: it should therefore be taken, if possible, from a poor thin soil. The turf which lies immediately over the chalk is best adapted to this purpose. If the ground to be covered is of a rich quality, it is best to remove the soil and lay some of the poorer subsoil bare, to place the turf on: a rich moist soil would make the grass grow too rank, and require constant mowing and rolling to keep it down. Brickbats and rubbish are often spread over the ground, where a lawn is to be formed by turfing it over: these not only form a poorer soil, but also keep it drier by their porosity. It need not be observed, that where turfing is resorted to, to cover bare places in meadows or pasture, the reverse of all this should be done, and manure spread over the places where the turf is to be laid, so that the roots may be invigorated and a rich pile of grass may spring up.

When there are banks and inequalities in pastures, it is often useful to pare off all the turf, rolling it up, from the places which are to be levelled. The superfluous soil is then removed, and if it has been long in the form of a dry bank, it is spread over the grass, which it greatly invigorates. The new surface is enriched with manure, if it requires it, and in moist weather or after watering it, the turf is rolled over it and well beaten down. A heavy roller drawn over it will greatly assist its rooting, and thus an unsightly bank, on which the grass was usually either coarse or burnt up, according as the season was wet or dry, becomes a good and neat pasture. Another important use of turf is to cut it into small strips and divide these into pieces of a square inch in size, or somewhat more, for the purpose of laying land to grass by *inoculation*. This is only a partial turfing, which extends rapidly, and in the course of a very few years converts a field which was not very productive as arable land into a valuable meadow, especially if it is so situated as to be capable of occasional irrigation.

The advantage of an extent of fine turf for the exercise of high-bred horses has given a name to the pursuit of breeding and training horses for the purpose of racing. The annals of the turf record the deeds of famous horses and the success of their owners. The turf has its rules and codes of laws, and the highest individuals in the nation often sit in judgment on some disputed point of turf law, with as much gravity as they would decide the most important interests of the state.

TURGOT, ANNE ROBERT JACQUES, was born in Paris on the 10th of May, 1727. He was descended from one of the most antient families in Normandy, and the name (the 'God Thor') seems to imply that he was of the race of those northern conquerors who gave their name to Normandy, and the greater proportion of whom afterwards emigrated to England with their chief William, called William the Conqueror. His father, Michel-Etienne Turgot, was Président aux Requêtes du Palais, and afterwards Prevôt des Marchands, councillor of state, and first president of the Great Council. His great-great-grandfather Jacques Turgot was one of the presidents of the noblesse of Normandy in the States of 1614. Being the youngest of three sons, Turgot was destined by his parents for the ecclesiastical profession, for which his taste for study, the modesty and simplicity of his manners, and a sort of timidity which kept him aloof from dissipation, appeared to fit him. But he very early formed a resolution not to be an ecclesiastic. Turgot's earnest, early imbibed, and single-minded love of truth and justice represented to him the immorality of taking a solemn engagement to maintain always the same opinions, to preach what he might perhaps cease to believe, and to teach to others as truths what he might regard as errors. With his passion for science, as well as literature and poetry, it might be supposed that, having obtained his father's consent to his plan of not entering the church, he would have desired no other employment than that of a man of letters. But Turgot resolved, without discarding his favourite pursuits, to adopt a more active employment than that of a mere man of letters or science; an employment which he foresaw would enable him to exercise a more direct and effective influence on the affairs of men than any mere closet philosopher, however gifted, can hope to do.

Turgot having determined to adopt the profession of the bar, or the robe, as it was called in France before the Revolution, selected that branch or department the members of which used to be called masters of requests (Maîtres des Requêtes). The maîtres des requêtes seem originally to have been magistrates who laid the written requests or petitions of parties before the king's council presided over by the chancellor. The term afterwards also came to signify those members of the profession of the robe, or bar, whose business it was to make a verbal report of cases before the council of state. (*Dictionnaire de l'Académie Française*, art. 'Requête.') The nature of the occupation of a master of requests, as followed by Turgot, will appear from the following anecdotes told by Dupont de Némours in his 'Memoirs,' the first of which contains a hint that may be useful to many a young lawyer besides Turgot. The first time that Turgot made a speech before the king, he thought it his duty to state and argue the case in as few words as possible. After he had ended, some of the councillors of state said to him, 'You have spoken very well, but you have been a little long; be more brief another time.' It might well be supposed that such advice, under such circumstances, somewhat puzzled the young lawyer. Turgot reflected on it, and on his second appearance before the council pursued a different course. He developed very much in detail the facts of the case and the evidence in support of them, and he recapitulated each head of his speech before he proceeded to the following head; and then recapitulated the whole a second time at the end. 'You have corrected your fault,' they said to him; 'you have said a great deal, and you have been brief.' On another occasion, when Turgot supported his conclusions by arguments drawn rather from the spirit than the letter of the law, the council rejected them, but eight days after the two parties compromised the matter, conformably to Turgot's conclusions, and without regard to the decree of the council. (*Mémoires*, par Dupont de Némours, pp. 29-32.) It would appear from the above cases, that the business of a maître des requêtes, as followed by Turgot, corresponded in some respects with that of a counsel in England practising before the privy council; with this difference however, that the maîtres des requêtes were not employed by parties or for them, but by and for the court: so that in some respects they resembled rather our masters in Chancery; with this difference again, that the master in Chancery's report is written, and neither spoken nor yet read by himself.

In 1761 Turgot was appointed intendant of Limoges. The office of intendant of a province in France, before the Revolution, was an administrative office. Turgot had, with a view of preparing himself for the duties of his new office, specially studied those branches of science which had most relation to them; particularly such of the physical and mathematical sciences as applied to agriculture, to manufactures, to commerce, to the construction of public works. During the thirteen years that the province of the Limousin was under the administration of Turgot, the more equitable distribution of imposts, the making of roads, the militia, the providing of subsistence for the people, and the protection of commerce, were the principal objects of his labours. He also applied himself to give activity to the Society of Agriculture of Limoges, and to direct its labours towards a useful end; he caused the midwives, who were scattered over the country, to be properly instructed; he secured to the people, during epidemics, the assistance of skilful physicians; and he introduced into his district the cultivation of potatoes, which the people at first looked down upon as a sort of food unfit for man; but Turgot overcame their prejudices by using them at his own table.

Turgot's plans for the 'repartition des impôts,' and for the removal of the 'corvées,' the old contrivance for the repair of roads and bridges, deserve, on account of their importance, a few words of explanation.

The greater part of the lands of Turgot's province of the Limousin was farmed by 'metayers,' whom the owner of the land furnished with the seed, cattle, implements of husbandry, and everything necessary for the cultivation of the farm. Under this form of cultivation, Condorcet says, it was very difficult to distinguish between that portion of the whole produce of the land which was to pay the expenses of cultivation, in other words, the interest, or rather profits of the capital advanced in the shape of cattle and implements of husbandry, as well as the wages of labour, and that portion which remained after such payment in the shape or under the name of 'produit net,' or rent. But it is evident that, according to the above account, the metayers bore only the character of labourers, without in any degree partaking of that of capitalists. Consequently whatever part of the produce went to them must be considered simply as the wages of labour; while what went to the proprietors consisted at once of the rent and the profits of capital.

Instead of the impôts or land-tax being raised upon that part of the whole produce which could be justly considered as produit-net, or rent, the only part which consistently with justice and with sound principles of public economy can be subjected to taxation, the tax was imposed and levied without reference to that, and a part, probably the principal part of the tax, operated as a tax upon labour and capital. Turgot laboured long and ardently, but in vain, to obtain an adjustment of this matter—a measure which he considered as of such paramount importance, that he remarked, that no man who really believed the 'impôt territorial,' or land-tax, properly apportioned, impracticable or unjust, could possess sound views on administration. Turgot seems to have considered that the best mode of levying the land-tax was to take a certain proportion of the rent. He seems also to have considered that this tax, properly apportioned and levied would supersede the necessity of all other taxes. He says, 'A fixed law might terminate for ever all disputes between the government and the people, and particularly by fixing one scale for war and another for peace. Arrangements would be made in consequence in purchases and sales, and the part of the rent that bears the tax would no longer be purchased, any more than the share of the curé. At the end of some time, it is very true that nobody would pay taxes. But the king would be proprietor of a proportional part of the revenue of all the land. This revenue would increase with the riches of the nation; and if this increase of wealth increased wants, there would be a sufficiency to supply them. The riches of the king would be the measure of the riches of the nation; and the administration always affected by the reaction of its errors, would constantly be instructed by the simple calculation of the produce of the taxes.' (*Œuvres de Turgot*, tom. iv., p. 255.)

Another great object of Turgot's labours was to deliver the Limousin from the oppressive burthen of the corvées; which consisted in the repair of the highroads by the compulsory labour of the poor inhabitants of the district. This impost pressed directly and exclusively on the poor man, the principle having been adopted of exacting it in kind. The hardship was extreme: men who had only their day's wages to live on were compelled to work without wages; the beasts necessary to the tillage of the ground were taken away from their work without regard to the inconveniences thereby occasioned. Besides this, the roads were made with ill-will. The workmen were ignorant of the art of road-making; so that the frequent repairs of the roads, either made badly or with bad materials, were necessary consequences. Turgot proposed to the 'communautés' adjoining the highroads to have the work done by contract. By this means the original construction of the roads was at once more substantial and more economical, and they could be kept up afterwards at a less cost. Thus those features of the corvées that implied constraint and personal servitude disappeared. The unjust distribution of the impost for paying the contractor still remained; for it was beyond the power of an intendant to alter it.

On the death of Louis XV. a wider field was opened for the execution of Turgot's enlarged and beneficent policy. The state of France, oppressed and exhausted by an accumulation of abuses, demanded a reforming minister; and the public voice called Turgot to the highest offices, as a man who united to all the knowledge which is the result of study the experience acquired by habits of business. He was at first appointed minister of the marine; but after continuing only a month in this situation, in which he felt that he wanted much of the necessary knowledge, he received the appointment of comptroller-general of finance, an employment for which all the labours of his previous life had prepared him. The comptroller-general of finance was then prime minister of France.

In his letter to the king, of 24th August, 1774, Turgot said, 'I confine myself at present, Sire, to reminding you of these three words—No bankruptcy, no augmentation of imposts, no loans. To fulfil these three conditions,' he says, 'there is but one means: to reduce the expenditure below the receipt, and sufficiently below it to be able to economise every year twenty millions, in order to clear off the old debts. Without that the first cannon fired will force the state to a bankruptcy.' He then explained at some length the means which he considered the best for effecting the saving in question, and thus concluded:—'These are the points which your majesty has permitted me to recall to you. Your majesty will not forget that in accepting the place of comptroller-general, I felt all the value of the confidence with which you honoured me. I felt that you intrusted to me the happiness of your people, and, if I may be allowed to say so, the care of rendering your person and your authority beloved; but at the same time I felt all the danger to which I exposed myself. I foresaw that I should have to contend alone against abuses of every kind, against the efforts of those who gain by those abuses, against the mass of prejudices which are opposed to all reform, and which are so powerful a means in the hands of interested persons to eternalize disorders. I shall even have to struggle against the natural goodness, against the generosity of your majesty, and of the persons who are most dear to you. I shall be feared—even hated —by the greatest part of the court, by all who solicit favours; and they will impute to me all the refusals, they will represent me as a harsh man (*dur*), because I shall have represented to your majesty that you ought not to enrich even those whom you love at the expense of the substance of your people. That people to whom I shall have sacrificed myself are so easily deceived, that perhaps I shall incur their hatred by the very measures which I shall employ in their defence. I shall be calumniated, and perhaps with sufficient appearance of truth to deprive me of the confidence of your majesty. I should not regret the loss of a place to which I never raised my expectations. I am ready to give it up as soon as I can no longer hope to be useful in it; but your esteem, the reputation of integrity, the public good-will, which have determined your choice in my favour, are dearer to me than life. Your majesty will remember that it is on the faith of your promises that I undertake a burthen perhaps above my strength; that it is to you personally, to the honest, the just, and good man, rather than to the king, that I give myself up.'

One of the first measures of Turgot was the establishment of a free trade in corn in the interior of the kingdom. He threw down those artificial barriers, in the construction of which man had employed a perverted ingenuity, to prevent one province which might chance to labour under a temporary famine arising from a bad harvest, from being relieved by the superabundance of a more fortunate district, and thus constantly retain some part of the kingdom in misery and distress, and at the same time cramp the energies and diminish the resources of the whole. He felt at the same time how much perfect freedom in the external trade in corn would add to the security of subsistence, but he knew that the time was not yet arrived when such a measure could be attempted with success. Besides the restrictions on the free passage of corn from one part of the kingdom to another, there were numerous local restrictions and exactions, most of which (such as the exclusive privilege of bakers, the 'banalité' of mills, &c.) were removed during Turgot's administration. He also passed a law abolishing the corvées throughout France, a law which, with the characteristic infatuation of the privileged classes, who would give up nothing till it was too late, was revoked immediately after Turgot's removal from office. By these different laws, the servitude of the inhabitants of the rural districts was nearly destroyed. Turgot also abolished most of the restrictions and exclusive privileges under which the inhabitants of the towns suffered. Freedom of trade was granted to the glass-works of Normandy, which, being obliged to supply Paris and Rouen with a certain quantity of glass at a low price, would have derived no advantage from bringing their manufacture to perfection, and had remained in that state of mediocrity to which oppressive laws condemn all the manufactures which have the misfortune to be subjected to them.

In regard to his financial operations, the characteristics of Turgot's administration were exactness in payments, fidelity to engagements, a reduction of expenditure whenever it could be effected without hardship and injustice. Pensions were three years in arrear: Turgot caused two years to be paid at once of all those which did not exceed 400 livres; that is, of all which were necessary for the subsistence of the parties to whom they had been granted. Ten millions due for advances made to the colonies had been payable for five years, and the payment of them had been suspended. Turgot paid at first 1,500,000 livres, and secured a million yearly for the payment of the rest. The finance appointments had been multiplied with the sole object of procuring a temporary supply by the first sale of offices. Most of the offices were double. Turgot proposed to reduce the double offices to a single one; to make the functionary whose office was retained reimburse him whose office was abolished; and when one person held two places, to suppress the salary of one of them.

'Such,' observes Condorcet, 'had been the operations, such were the views of M. Turgot; and it was thus that, while they accused him of not knowing finance, apparently to console themselves for the superiority which they were obliged to acknowledge in all the important parts of the administration, he had augmented the public revenue without putting on a new impost, and after having suppressed or diminished several; and that without having recourse to new loans, he had made repayments and diminished the debt. All these labours had been the work of twenty months; and two attacks of gout, an hereditary malady in the family of M. Turgot, had hindered him for several months from carrying on his plans. The forced labour to which his zeal for the public good had made him devote himself at the peril of his life had prolonged these attacks, and rendered them dangerous.' (*Vie de M. Turgot*, pp. 115, 116.)

In short, those men of all ranks and every profession who subsisted at the expense of the nation without performing any service in return, who lived by abuses—nobles, courtiers, financiers, farmers of the revenue—all united in a powerful confederacy against Turgot, and succeeded in driving him from his office after he had held it not two years.

After his retirement from office he occupied himself less than formerly with political matters, particularly with such as had reference to the government and the laws of France. The sciences to which he now chiefly devoted his attention were the physical and mathematical. He likewise continued to indulge his early taste for literature and poetry. He had never lost the habit of making verses—an amusement very valuable to him in his journeys and during the sleepless nights caused by the gout. But he seldom showed his verses: a few fragments were made public, and were attributed by the critics to Voltaire. All that was known of his lucubrations in that department was a single Latin verse, intended for the portrait of Franklin—

'Eripuit cœlo fulmen, sceptrumque tyrannis.'

Among the many points in which Turgot was in advance of the statesmen of his age, there is none that will strike an English reader more than the view he took of the American war as compared with the views even of the most enlightened of the contemporary English statesmen on that subject. Even Burke, who saw farther than the others, had not admitted into his calculation the consideration of the most remote possibility of the ultimate independence of the colonies. Turgot's 'Mémoire' on the American war contains views on the nature of colonies that have been recognised since by the soundest thinkers on those subjects as correct ones. His work on the laws against usury contains almost all that is valuable in Bentham's Letters on the usury laws, written many years later: not that Bentham copied Turgot; he probably did not know of his work; but the fact is as stated. His article 'Fondation,' also in the 'Encyclopédie,' contains many ideas which were new at the time, and some, the soundness of which has not yet been overthrown.

The principal fault that was attributed to Turgot as a statesman was want of address. He himself thus answers the charge in his letter to Dr. Price:—'Dr. Franklin has sent me, sir, as from you, the new edition of your "Observations on Civil Liberty, &c." I have to thank you doubly: first, for the work itself, of which I have long known the value, and which upon its first publication I read with avidity, notwithstanding the multiplicity of business in which I was engaged; and, in the next place, for your candour in suppressing the imputation of want of address, which you had inserted, among many things much to my advantage, in your "additional observations." I might have deserved the imputation, if you had meant no other want of address than that of not being able to discover the secret springs of those intrigues which were practised against me by persons much more adroit in that respect than I am, or ever shall, or ever desire to be. But I understand you to charge me with a want of address in grossly shocking the general opinion of my nation; and, had that been your meaning, you would not have done justice either to me or to my nation, which is much more enlightened than is generally thought by yours, and which is perhaps more easily prevailed on to adopt rational ideas than even the English. I come to this conclusion, as well from having seen your countrymen so infatuated with the absurd project of subduing America, that nothing could in the least open their eyes till the capture of Burgoyne, as from the system of monopoly and exclusion which is in fashion with all your political writers upon commerce, except Mr. Adam Smith and Dean Tucker, and which is the true source of the loss of your colonies, and from all your controversial writings upon the questions which for these twenty years past have been discussed among you, in not one of which that I remember to have read, till your observations were published, is the question considered in its true point of view; I never could conceive how a nation which has so successfully cultivated every branch of the natural sciences could remain so far inferior to itself in the most important of all sciences, that of public happiness; a science in which the liberty of the press, that exists nowhere else, must have given it such vast advantages over every other country in Europe.'

But as we are informed by his biographers that he could not dissemble his hatred for knaves, his contempt for cowardice or baseness; that those sentiments involuntarily showed themselves on his countenance; even when we take along with this what these friendly biographers add, that as they were only the consequence of his love for mankind, they neither inspired him with a spirit of injustice nor of vengeance: yet when we consider of what materials that portion of his countrymen were composed with whom he must have come chiefly in contact as prime minister of France, we need not be surprised that he made himself many enemies; and that want of address was imputed to him even by those who were not his enemies. But in whatever degree the charge may derogate from his claim to practical talent in statesmanship, it leaves untouched his character as a statesman for reach of intellectual vision, for purity and benevolence of intention, for undeviating adherence to principle hitherto unrivalled.

Turgot's attacks of gout before his ministry had been painful, but not dangerous. The violent and incessant labour to which he devoted himself in the midst of these attacks during his ministry changed the nature of them; and when he was restored to leisure, it was too late for repose to repair the mischief that had been done. The attacks became more and more frequent, and at last he sunk under them. His last attack, which was long and severe, did not impair his mind nor even his temper. 'He only displayed towards his friends,' says Condorcet, 'a more lively sense of the attentions they showed him; and his spirit beheld with tranquillity the approach of the moment when, according to the eternal laws of nature, it was about to fill in another sphere the place which those laws had marked out for it.' (*Vie de M. Turgot*, p. 206.) He expired on the 20th of March, 1781.

The following are the principal works of Turgot:—Articles in the *Enclycopédie*—'Etymologie,' 'Existence,' 'Expansibilité,' 'Foires et Marchés,' 'Fondations;' 'Eloge de M. de Gournay;' numerous official letters, memoirs, and projéts, lois, édits, &c.; 'Réflexions sur la Formation et la Distribution des Richesses;' 'Lettres à M. le Contrôleur-Général sur le Commerce des Grains;' 'Extension de la Liberté du Commerce des Colonies;' 'Lettre à M. ———, Maire de Rochefort;' 'Lettre à M. l'Abbé Terray sur la Marque des Fers;' 'Sur la Prosodie de la Langue Française et la Versification Métrique;' 'à M. de C. sur le Livre de l'Esprit;' a complimentary Letter to Dean Tucker on the occasion of M. Turgot's translating into French Tucker's work, entitled 'The Case of going to War for the Sake of Trade, considered in a New Light.' [Tucker, Josiah.]

Condorcet, in his Life of Turgot, gives a good many opinions and speculations in metaphysics, morals, and legislation, which formed, he says, detached portions of a great work which Turgot had projected, but which he had not even begun to write, and were gathered by Condorcet from his conversation.

(*Vie de Monsieur Turgot* (par Condorcet), Londres, 1786; *Mémoires sur la Vie et les Ouvrages de M. Turgot, Ministre d' Etat*, par Dupont de Némours, Philadelphie, 1788; *Oeuvres de M. Turgot, Ministre d'Etat*, 9 vols. 8vo., Paris, 1808.)

TURIN. [Torino.]

TURINSK. [Siberia, vol. xxi., p. 471.]

TURKEY. [Pavonidæ, vol. xvii., p. 335; Poultry, vol. xviii., p. 480.]

TURKEY, TURKS. Turkey is an empire situated in Europe, Asia, and Africa. The several portions of which it consists have been described under the heads Anatolia, Constantinople, Bulgaria, Candia, Egypt, Greece, Rum-Ili, Tripoli, &c. Besides those extensive provinces which are under the immediate sovereignty of the Sultan, this empire contains the following vassal states:—1. Moldavia; 2. Wallachia; 3. Servia; 4. Egypt; 5. Tunis; 6. Tripoli in Africa; 7. Algiers, now a French colony, but the sovereignty of which has never been ceded by the Sultan. These vassal states have also been treated under their several heads.

The Turkish empire is divided into 'eyalets,' or large provinces, containing each a number of 'sanjaks,' or 'liwas,' that is, districts. In the enumeration of them we shall follow the political divisions made by order of Sultan Selim III.; but we shall omit such provinces as have since been ceded to foreign powers, and add such changes as have since been made, following the authority of Balbi and Malte-Brun. The initial B. or M. put after the name of a province indicates that the name is not in the division of Selim III., but has been taken from the works of one of these geographers, whose chief authorities are Mouradja d'Ohsson, and Jouannin.

Eyalets in Europe:—

I. Rúm-ili, with 16 sanjaks: 1, Monastir, the residence of the pasha of the whole eyalet; 2, Selánik; 3, Tirhalá, or Trikala; 4, Iskenderiye, or Scutari; 5, Okhri, or Okhrida; 6, Awlonia, or Valona; 7, Güstendil; 8, Il-bessan; 9, Perserín; 10, Dukagín; 11, Uskub, or Scopi; 12, Delonia, or Delvino; 13, Wuljterín; 14, Káwalá; 15, 'Alájá-hissar; 16, Janina, or Joannina.

II. Silistra, or Silistria, once contained eight sanjaks, but it now contains only six: 1, Nikopoli; 2, Chermen; 3, Wize; 4, Kirkkilissa; 5, Belgrade (B.), which is only a military command in the town of Belgrade; 6, Widdin.

III. Jezayr, or the islands of the Archipelago, and some parts of the continental coast of Asia and Europe; it is the eyalet of the Kapudan Pasha, and now contains only five sanjaks: 1, Geliboli, or Gallipoli; 2, Rhodes; 3, Mitylene, or Midilli; 4, Kibris, or Cyprus; 5, the Castle of the Dardanelles. (Chios? B.; Samos? B.)

IV. Bosnia, with 4 (?) sanjaks: 1, Bosna-Seraï; 2, Zwornik; 3, Herzek, or Herzogevina; 4, Klis. (Widdin? B., Adaï-Kebir? B.)

Eyalets in Asia:—

V. Anatoli, or Anatolia, contains 14 (?) sanjaks: 1, Angora; 2, Aïdín; 3, Bolí; 4, Tekke; 5, Amid; 6, Khudáwend-kiar; 7, Sultanöni; 8, Sarú-khán; 9, Kastemuní; 10, Kárá-hissar; 11, Kárá-su; 12, Kanghrí; 13, Kutaïeh; 14, Menteshe. Balbi, whose authority is Jouannin, gives eighteen sanjaks, several of which have other names than those in the division of Selim.

VI. Karamán, or Caramania, has seven sanjaks: 1, Koniah; 2, Ak-seraï; 3, Ak-shehr; 4, Beg-shehr; 5, Kir-shehr; 6, Kaïsarieh; 7, Nikde. (Maden? B.; Gurúk? B.; Larenda? B.)

VII. Siwás has seven sanjaks: 1, Siwás; 2, Amasia;

3, Chorum; 4, Bozok; 5, Diwrijí; 6, Janik; 7, Arabgir. Balbi mentions eight sanjaks, several of which have other names.

VIII. Trabesun, or Trebizond, has three sanjaks: 1, Trabesun; 2, Gonia; 3, Batum.

IX. Kars contains at present three sanjaks: 1, Kars; 2, Aní; 3, Erdanují.

X. Childir contained twenty very small sanjaks in the time of Selim; but the greater part of this eyalet has been ceded to Russia, and the remaining and smaller part has been united with the eyalet of Kars, of which the eastern part has likewise been ceded to Russia.

XI. Erz-rúm contained fourteen sanjaks during the reign of Selim, but it seems that it has now only the following eight: 1, Erz-rúm; 2, Kamakh; 3, Maden (?); 4, Erz-inján; 5, Kárá-hissar (?); 6, Gümüsh-kaneh.

XII. Wan had fourteen sanjaks, including the dominions of some hereditary chiefs; but it has now only five: 1, Wan; 2, Mush; 3, Bedlis; 4, Khoshab; 5, Bayazid.

XIII. Rakká had ten sanjaks, which are now reduced to the following five: 1, Rakká; 2, Orfá; 3, Bir; 4, Tor; 5, Khabur.

XIV. Diyarbekir had twenty-six sanjaks, but Balbi mentions only three: 1, Diyarbekir, or Kárá-Hamid; 2, Maden (?); 3, Siwerek: besides which there are several principalities of the Kurd chiefs, such as Palu, Agil, Guh, and others.

XV. Shehrzol, or Shehrzur, formerly contained thirty-two sanjaks. It has lately been united with the eyalet of Baghdád, and contains the sanjaks of—1, Kerkuk; 2, Shehrzol; 3, Erbil; 4, Bayán. There are several principalities of the Kurds in this eyalet.

XVI. Mosul had six sanjaks, but has now only two, Mosul and El-kosh. Several tribes of Kurds, Turkomans, and Arabs are quite independent.

XVII. Baghdád contained eighteen sanjaks, but has now only nine, besides those of the eyalets of Shehrzol and of Basrah united with Baghdád. The sanjaks are—1, Baghdád; 2, Meshed-'Ali; 3, Meshed-Husein; 4, Hillah; 5, Aná; 6, Nisibi; 7, Mardin; 8, Basrah; 9, Korná. It contains also several half-independent principalities of the Kurds, and there are some tribes of Arabs that are quite independent.

XVIII. Mer'ash had formerly five, and has now only four sanjaks: 1, Mer'ash; 2, Aïntab; 3, Malatia; 4, Albostán, B. (Karsz?)

XIX. Basrah, or Bassora, contained thirty sanjaks during the reign of Selim, and a great number more before the accession of this sultan: it is now united with Baghdád.

XX. Adáná had formerly five, and has now seven sanjaks: 1, Adáná; 2, Tarsus; 3, Alayeh; 4, Sis; 5, Páyas, B.; 6, Anemur, B.; 7, Selefkeh, B. (Ichil?)

XXI. Haleb, or Aleppo, contains six sanjaks, the names of which in Balbi do not always agree with those in the division of Selím. 1, Haleb; 2, Klis, or Killis; 3, Bális or Bailán; 4, Skanderun or Alexandretta, B.; 5, Antakia, or Antioch, B.; 6, Shogr, Jesr-Shogr, or Sheggur, B.

XXII. Tripoli, or Tarablus, in Syria, had formerly five, and now has two sanjaks: 1, Tripoli; 2, Latakia. This eyalet contains the half-independent countries of the Nozairis, the Maronites, and the Ismaelites, which have the names of sanjaks in the division of Selim.

XXIII. Damascus, or Damas, had formerly eight sanjaks. ording to Balbi, it has now twelve:—1, Damascus; mah; 3, Hems; 4, Tadmor; 5, Jerusalem; 6, Bethle- Kalíl, or Hebron; 8, Ráyh, or Jericho; 9, Nablus, 10, Gaza; 11, Ramlá; 12, Jaffa, or Joppe.

cre, or Akká. This eyalet is not in the list of ontains five sanjaks:—1, Beirút; 2, Saïde, or , or Tyrus; 4, Nasrah, or Nazareth; 5, Taba- this eyalet are situated the half-independent Mutualis and of the Druses.

ful if the Syrian eyalets are still divided ving been for a long time in possession gypt, Mehemed 'Ali, who has lately been re them to the Sultan. Since this event ny accurate information concerning the sion of these provinces.

idda and Saïda in Arabia; the number of sa en.

XX s considered as an eyalet, divided into twelve ch of which was formerly governed by a bey of t luks.

XXVIII. Creta, or Candia, has three sanjaks:—1, Canea; 2, Retimo; 3, Candia.

The administration of the provinces is described below. We only observe here that the number of sanjaks in Asia has greatly diminished; and that neither the eyalets nor the sanjaks have such invariable limits as provinces in Europe usually have.

The present sultan, Abdú-l-Mejid I., succeeded his father Mahmud II., in A.H. 1256 (A.D. 1840). The Sultan of Turkey is absolute in this sense, that there is no political body in the empire which has any recognised power to check his will: but he is obliged to reign conformably to the religious, political, and civil principles contained in the Korán; conformably to the Sunna, or the words of the prophet Mohammed preserved by tradition; and to the unanimous decision of the assembly of the Ulemas, in which the Mufti presides; and conformably to the Kanun-náme. The Kanun-náme, a word derived from the Greek (κανὼν), is a kind of code containing decisions and institutions which have been made since the beginning of the empire, and conformably to the Korán. This legislation is also called 'Urfí,' or the arbitrary legislation, because it treats of such matters as have only been decided in a general way by Mohammed. However, as the principles of absolute monarchy contained in the Korán are very large, and the Sultan is the chief of the Mohammedan religion as successor of the Khalifs, his power is less checked by law than it is by custom, by public opinion, and by the rebellious spirit of his subjects.

Government.—The civil and religious law having only one source, the Korán, the highest dignitary is the Mufti, who is the supreme authority with regard to the legality of religious, civil, and political acts: he is the patriarch and the high chancellor of the empire. His counsellors are, the Sheikhu-l-islám Kiayazi, or vice-mufti; the Telkhisjí, the representative of the mufti for daily affairs; the Mektubjí, or chancellor; and the Fetwá-Emini, or director of the chancery for the issue of fetwás, or ecclesiastical decrees. The Sultan does not declare war nor conclude peace: nor does he undertake anything of importance without previously asking the Mufti and his Ulemas 'if it is comformable to the law;' and the Mufti decides the matter by a fetwá. Sometimes also the nation applies to the Mufti for similar purposes, especially in cases of rebellion, which becomes a legal opposition as soon as the motive of it is declared to be just and legal by a fetwá. The Mufti and his counsellors, the high judges of Rúm-ili, of Anatoli, of Constantinople, of Mecca, of Medina, and several other high functionaries, are called 'the dignitaries of law' (Menasibi-sheriye), or 'the dignitaries of science' (Menasibi-ilmiye). The assembly of these functionaries is called the assembly of the Ulemas, or 'wise men.' Ulema is the general name of theologians and jurists, who are bound to aid the Mufti with their advice when he summons them to his assemblies. All the Kadis, or judges, and the 'muderris,' or professors of sciences, are under the authority of the Mufti. The council of the Mufti is not unlike the Ministry of Instruction and of Ecclesiastical and Medical Affairs in Prussia, which however has not the administration of justice. [ULEMA.]

State Dignities.—I. Dignities of the pen.—They are divided into three classes, viz. Rijál, Khojá, and Agha.

1. Rijál. The members of this class form the Sublime Porte of the grand-vizír, or the state ministry and state council, the president of which is the grand-vizír. Under him are three ministers:—1, the Kiaya-bey, or minister for home affairs; 2, the Reis Efendi, or minister of the foreign office; 3, the Chaush-bashi, or minister of the executive power, under whom are 360 chaush, or state messengers, divided into 15 companies, commanded each by a bulukbashi; but the title of rijál belongs only to the above-mentioned three ministers, and to six under-secretaries of state, among whom is the Kanunjí, or the minister who has the revision of the decrees and other legal acts of the ministers, and who takes care that these decrees are conformable to the principles of the Kanun-náme.

2. Khojá. The members of this class form the Porte of the defterdar, or the ministry of finance, the director of which is the first defterdar. Under him are the second and the third defterdar; the Nishanjí-bashi, or secretary of state for the sultan's signature (seal-keeper); and the Defter-emini, or the superintendent of the office of finance, who have the rank of ministers. The ministers have the

title of Vizír, and their assembly is called the Diwan: they are also called Vizírs of the Cupola, because they used to assemble in an apartment surmounted by a cupola.

3. Agha. To this class belong, or belonged, several military and civil officers, such as the Bostanjí-bashi, or commander of the guard of the gardens within the Seraglio; the Topjí-bashi, or commander of the artillery; the Mirí-'Alem, or bearer of the standard of the Prophet; the Ihtisab-agha, or præfect of the public markets; the Kapijíler-kiayazí, or great chamberlain; and others. Several of these functions have been abolished, as observed below.

II. Dignities of the Sword. To this class belong the governors of the eyalets, or Beyler-beys, who are pashas of two tails; the governors of the sanjaks, or Sanjak-beys, who are pashas of one tail; and the governors of the woiwodships, or under divisions of the sanjaks, who are not pashas, but only beys. The vizírs are pashas of three tails, and so is the Serasker, or general-field-marshal; but the rank of a vizír is often given to the governors of eyalets, and the governors of the sanjaks are very often pashas of two tails. The governor of an eyalet has always a sanjak, or sometimes several, of which he is also the governor; and he has little authority over the subordinate governors. The pashas combine the functions of military commanders, of judges, and of receivers of the taxes. With regard to the taxes, there is a double mode of administering the sanjaks. The pashas either hold their province for life, and pay annually a certain sum to the treasury of the empire, in which case they are called 'Mutesarrif;' or they give an account of the yearly income of the province to the defterdar in Constantinople, in which case they hold the province only for a certain time, and are called 'Mute-sellim.' If a pasha receives a second sanjak, he is neither mute-sarrif nor mute-sellim in respect of it, but 'Muhasil,' or 'receiver of the taxes.' There is great confusion in the system of administration; and it depends entirely upon the sultan to change the division of the eyalets, and to make as many sanjaks or woiwodships of them as he finds convenient to give to his officers.

The late sultan, Mahmud II., made great changes with regard to the high functions of the empire. A considerable number of subordinate places, especially in the Porte of the defterdar (finance) was abolished, and important changes were made concerning the rank of the different functionaries, who all wear a kind of European uniform. The changes in the army were radical: the Janissaries were exterminated, and the regular troops received a European organization. The general-field-marshal has still the name of Serasker, or Serasker-Pasha. The second in rank is now the Beyler-Bey Vizír, or the commander of the Sultan's life-guard, whose full title is 'Mushirí-ásakirí Khasá,' or 'councillor of the house-troops.' The Beyler-Bey Vizír has been substituted for the Bostanjí-Bashi, a dignity which was abolished, like that of the Mirí-'Alem mentioned above. The Mushirí-Topkháney-'Amire, or 'the councillor of the imperial artillery,' is another new military dignitary, who has been substituted for the Topjí-Bashi. The army, foot as well as horse, is divided into 'ferik,' or divisions commanded by a Ferik-Pasha. Each 'ferik' is divided into 'líwa,' or brigades commanded by a Mirí-líwa-Pasha; a 'líwa' contains two 'álaï,' or regiments commanded by a Mirí-álaï-Bey, or colonel; an 'alaï' is composed of four 'tabur,' or battalions, commanded by a Binbashi, or major; each 'tabur' has eight 'buluk,' or companies, commanded by a 'Yüz-bashi,' or captain; and a 'buluk' is composed of eight 'on,' or sections, each commanded by an 'On-bashi,' or corporal.

Similar changes have been introduced into the civil department. Many offices in the imperial household have been abolished, such as those of the 'Silihdar-Agha,' or armour-bearer of the Sultan, which, in former times, was a post that gave great personal influence over the Sultan. The 'Dülbend-Agha,' or keeper of the Sultan's turban; the 'Kahwejí-Bashi,' or the first coffee-maker; the 'Bülbüljí-Bashi,' or the first nightingale-keeper; the 'Tutují-Bashi,' or the first parrot-keeper; the 'Chántají-Bashi,' or the keeper of the Sultan's purse, have likewise disappeared from among the officers of the imperial household. All the officers, attendants, soldiers, and servants employed in the Seraglio amounted in former times to 12,000 'swords,' that is, 'men,' besides the females. The first officer of the harem (a word which signifies 'the apartment of the women') and of the whole seraglio of the Sultan is the Kislar-Agha (the master of the girls), who is also called 'Babes-seadet-Agha,' or 'master of the door of happiness.' One of his first subordinate officers is the 'Peshkesjí-Bashi,' 'the surveyor of the presents,' who receives the presents which foreign ambassadors make to the Sultan. The women of the harem are divided into five classes:—1, 'Kádin,' or 'wives of the Sultan,' in number from four to seven; 2, 'Gediklü,' or 'chamber-maids,' among whom the Sultan usually chooses his 'kadin,' especially among the twelve handsomest of them, who have titles of honour. Those who are preferred by the Sultan are called 'Ikbal,' or 'children of happiness;' and 'Khass-odalik,' or 'private women of the Sultan.' In Europe they are generally called 'Odalisk,' which is not correct. 3, 'Ustá,' or 'mistresses,' generally called 'khalfáh,' or 'attendants,' divided into 'takim,' or companies of thirty women each; 4, 'Shagird,' or 'apprentices;' 5, 'Jaríyeh,' or 'slaves.'

The changes introduced by Mahmud II. into the system of scientific education are no less remarkable. This enlightened sultan improved the school for engineers founded by Selim III., and he founded a school for architects, and another for students of medicine. The medical school is divided into four classes. The students of the fourth class are mere beginners, and learn writing and reading; in the third class are taught the grammar and the syntax of the Turkish language, and foreign languages, such as Arabic and French; anatomy, physiology, materia medica, and therapeutics are taught in the second class; physic and chemistry, in the first class.

Other changes have been made in the coins, measures, the public feasts, and the ceremonies of the court.

According to Balbi (3rd edition, 1840), the area of the Turkish empire, including Egypt, but without Tunis, Tripoli (Africa), Servia, Wallachia, and Moldavia, is 1,033,200 square miles, of 60 to the degree, of which there are 110,200 in Europe, 556,000 in Asia, and 367,000 in Africa (Egypt and her dependencies). According to the same authority, this area is peopled by 22,500,000 inhabitants, of whom there are 7,000,000 in Europe, 12,500,000 in Asia, and 3,000,000 in Africa. Balbi estimates the revenue of Turkey at 460,000,000 francs, or 18,400,000*l*. sterling, an amount which seems too high, even if we admit 100,000,000 francs, or 4,000,000*l*. sterling, as the revenue of Egypt. The navy is composed of 23 ships of the line, 28 frigates, and 120 ships-of-war of an inferior order. The regular army is said to be 70,000 men in time of war. During the last war with Egypt the Turkish army consisted of double this number.

Inhabitants.—The inhabitants are divided into two great classes—the Turks, or, more correctly, Turks-Osmanlis, who are the ruling race; and the 'Rayas,' that is 'the flock,' who are the antient inhabitants of the countries conquered by the Turks-Osmanlis. The Rayas, who are Christians, except some pagan tribes, are subject to the capitation or poll-tax, which the Osmanlis do not pay: they have the exercise of their religion with some restrictions, and they are dressed in a different way from the Turks. In general the Rayas, although they form communities and have their local authorities, are entirely in the position and have all the disadvantages of a subdued race. The Rayas are far more numerous than the Turks, especially in Europe they belong to different nations. The Greeks are most numerous; the nations of Slavonic origin, the Bosniacs (only the Christian Bosniacs are R
Servians, the Bulgarians, as well as the Arm
likewise very numerous. Several nations wh
origin different from that of the Turks-Osma
theless not reckoned among the Rayas, bec
adopted the Mohammedan religion. To t
a great number of Kurd, Arabic, and T
Mohammedan Bosniaks, and the Albania
the inhabitants of antient Epirus. Forei
are considered as Rayas, but they are
authority of their ambassadors and con
imperial decree was issued, by whic
were granted to the Rayas, especially
administration of justice between them
the payment of taxes. This decree co
ciples of law which were taken fro
Civil.' In consequence of this, there
in Europe that the Rayas were set o
with the Turks, and in France it w

the Sultan had given a modern constitution to his subjects, and that the French Code Civil had been adopted as the general law of Turkey. It afterwards proved however, that, notwithstanding the decree, things continued the same as before.

History.—The Turks-Osmanlis are a branch of the Turks in the larger meaning of the word. The Turks, a family distinguished from other nations by their language, customs, and physical character, are thinly spread over an immense extent of Asia, from the desert of Gobi to the shores of the Mediterranean, and from the northern part of Siberia to the Persian Gulf. In some parts, as in South Siberia, in Turkistan, and in the greater part of Asia Minor, they form a compact population: in others, as in Syria, Armenia, and Mesopotamia, they are much less numerous than the original inhabitants. In Europe the Turkish population is compact in Rúm-ili, and in the government of Kazan and some adjacent tracts in Eastern Russia. In Africa there are only a few Turks-Osmanlis.

We cannot precisely ascertain when the Turks (we speak in the larger meaning of the word) first appeared in Europe, nor can we contradict those who say that some tribes were settled in Southern Russia as early as the beginning of Greek history. Herodotus (iv. 22) mentions a nation by the name of Iurcæ (Ἰῦρκαι), which probably lived south-west of the present town of Kiew. A nation which lived in the same country is named Turcae, or Turks, by Pliny (*Hist. Nat.*, vi. 7) and Pomponius Mela (i. 19). The learned Count J. Potocki (*Voyage dans les Steps d'Astrachan et du Caucase*, ed. F. Klaproth, vol. ii., p. 5) thinks that Pliny and Mela have had more correct copies of the work of this historian than we have, and that in the above-mentioned passage of Herodotus we must read Τῦρκαι, instead of Ἰῦρκαι. This opinion has been adopted by Eichwald (*Alte Geographie des Kaspischen Meeres*, &c., p. 285, &c.), and by Hammer (*Geschichte des Osmanischen Reiches*, x., p. 649), who adds, that the text of Herodotus would be correct even without the proposed alteration, Yürük, or Yuruk, being the well-known name of all nomadic Turks in Asia Minor and Persia. Strabo (p. 306, ed. Casaub.) does not mention Turks, but he mentions a nation called Urgi (Οὖργοι), which occupied nearly the same tract as the Iurcæ and Turcæ.

Eichwald (*ibid.*, pp. 288, 294, 295) proposes to alter Οὖργοι into Θύργοι, or Τῦρκαι (Thyrgi, or Tyrkai). The same author (p. 249) thinks that the Tauri, the antient inhabitants of the Chersonesus Taurica, now the Crimea, were likewise of Turkish origin. The general opinion is, that the Turks became first known to the Europeans through the Byzantines, in the fourth or fifth century, and this opinion has not been abandoned by F. von Klaproth. But however antient our knowledge of the Turks may be, they were known to the Chinese several centuries before there was an historian in Europe.

The history of the Turks cannot be well understood without a knowledge of the different tribes into which they were divided from the remotest times. According to Abú-l-ghazi, cited below, the tribes are:—1, the Oghuzes, Ghuzes, or Uzes, who called themselves Kuns, and who were known in Southern Russia under the name of Polowzi, the Kumani of the Byzantines; 2, the Kiptshaks [TARTARS, *Kiptshak*]; 3, the Kaláj; 4, the Karlik, or Kharlik; 5, the Kankli; 6, the Agach-erí, 7, the Uighurs. These seven tribes, of which the Khagan of the Avars (Turks), who was at war with the emperor Mauritius (A.D. 582-602), styled himself the master, were the most western Turkish nations, and first became known to Europeans. (Theophylact., vii., p. 174, ed. Paris.) From the Oghuzes, part of whom were afterwards called Turkmans, or Turkomans, sprung the following dynasties in Asia Minor, Persia, Syria, and Egypt:—1, the Ghasnewides; 2, the Seljuks; 3, the Beni Ortok; 4, the Atabegs; 5, the Turkoman dynasty of Akko-yunli, or the White Sheep; 6, the Turkoman dynasty of Kárá-yunli, or the Black Sheep; 7, the Beni-Akhshid; 8, the Beni-Tulak; 9, the first dynasty of the Mamluks in Egypt; 10, the second dynasty of the Mamluks in Egypt; 11, the Káyi, the Hoeyhe of the Chinese, the most illustrious of all, because the Turks-Osmanlis descend from them; 12, the Tiukiu, the Turks of the Altai, known to the Byzantines in the sixth century (Tiukiu is the Chinese pronunciation of Turk); 13, the Khirkhiz, now Kirghis; 14, the Kimak, or Kümük, now Kazí-Kümük, in Daghestán; 15, the Bejnak, known in Europe as Patzinacitæ, or Petshenegues; 16, the Tulází; 17, the Taghazghaz; 18, the Mejreke, now Mecher-yekes, in the southern part of the Ural; 19, the Zárih, or Zerdkerán; 20, the Kaytak; 21, the Kárá-kalpak; 22, the Odkesh; 23, the Monsok; 24, the Berendij, formerly in Russia; 25, the Borosák, on the Wolga; 26, the Tartars of the Golden Horde, a confederacy of several other tribes or parts of tribes [TARTARS]; 27, the Noghais.

The history of the Kiptshak, the Tartars of the Golden Horde, and of the Noghais, has been related under TARTARS—*Kiptshak;* CRIMEA; KAZAN; ASTRAKHAN: and that of the Khazars and other Turkish, or rather half-Turkish tribes, not mentioned by Abú-l-ghazi, under TARTARS—*Khazars*. We give here only the history of the most remarkable of the other tribes, the Oghuzes, the Seljuks, and the Osmanlis.

1. *Oghuzes.*—Tradition says that Oghuz-khan, the son of Kárá-khan, a descendent of Turk, who is the common ancestor of all the Turks, was a mighty king in the time of Abraham. His empire was the country called Turkistán [TURKISTAN], known to the Persians by the name of Turán. Under his successors the empire was divided: three khans, 'the three arrows,' ruled over the eastern Oghuzes, and extended their dominions towards China: three other khans, 'the three breakers,' were masters over the western Oghuzes, around the Oxus and the Jaxartes. The first of these 'three breakers' was the 'khan of the mountains:' he is the ancestor of the younger Oghuzes, or that part of the Oghuzes which preserved their name in later times, and of the Turkomans. The second was the 'khan of the sea,' the ancestor of the Seljuks; and the third was the 'khan of the heaven,' the ancestor of the tribe Kayi, from which are descended the Osmanlis. For many centuries the Oghuzes were perpetually at war with the Persians, and afterwards with the Arabs, who, in A.H. 93 (A.D. 711) conquered Bokhara and Samarcand. Boghra-khan Harún extended his dominions as far as China, A.H. 389 (A.D. 999). His empire was broken up by civil troubles during the fifth century A.H. (the eleventh A.D.), and became a prey to the Seljuks.

2. *Seljuks.*—Their ancestor Seljuk was a mighty under-khan of the Oghuzes, and lived towards the end of the fourth century A.H. (tenth A.D.). The influence of his family increased during the civil troubles by which the empire of the Oghuzes was shaken after the death of Boghra-khan Harún. Toghrul-Bey, his grandson, who lived in the middle of the fifth century A.H. (the eleventh A.D.), was an independent Mohammedan prince. His power was felt at Baghdád. Al Káyim-bi-amri-llah, the twenty-sixth khalif of Baghdád of the house of Abbás, who was an instrument in the hands of the Persian family of the Buyeh, was saved by Toghrul-Bey from the oppression of his haughty oppressors, and from the ambitious designs of his son Besasiri (Nassassiri in Deguignes) who was put to death by order of the khan of the Seljuks. The khalif rewarded his liberator with the title and power of the Amiru-l-omra, or 'prince of tne princes:' he married a sister of the khan, and Toghrul-Bey married a daughter of the khalif. In A.H. 462 (A.D. 1069) Toghrul-Bey was succeeded by his nephew Alp-Arslán, who also married a daughter of the khalif Al-Káyim. Alp-Arslán conquered a large part of Turkistán, the north-western part of Persia, Armenia, Georgia, Mesopotamia, and Syria. He was involved in long wars with the Greeks, which he terminated successfully in A.H. 464 (A.D. 1071) by a victory over the emperor Romanus, who became a captive of the Turks. The prime-minister of Alp-Arslán was Nizamu-l-Mülk, famous as a statesman and historian. Alp-Arslán's son and successor, Melek-Shah, conquered the greater part of Asia Minor, called by the Turks Rúm, or the country of the Romans. His successors were the masters of Asia Minor, Syria, Mesopotamia, Armenia, part of Persia, and Western Turkistán, during one hundred and thirty years. Towards the end of the seventh century A.H. (the thirteenth A.D.) their power was broken by civil dissensions, caused by the ambition of the royal princes and those of the under-khans. Mesud, who died in A.H. 697 (A.D. 1297), was only the shadow of a king. 'Alá-ed-din II., his successor, was the last sultan of the empire of the Seljuks. He was killed by the Mongols in A.H. 707 (A.D. 1307), and the Seljukian monarchy was divided into the following states, all, except one, governed by princes of the tribe of the Seljuks.

Kárási became master of Mysia; Sarú-Khan and Aïdìn reigned each in a part of Lydia; Menteshe in Caria; Teke in Lycia and Pamphylia; Hamid in Pisidia and Isauria; Káramán, the most powerful of all, was lord of Lycaonia, and reigned as sultan in the city of Koniah, once the capital of the Seljukian empire; Kermián founded a petty state in Northern Phrygia; Ghazi Chelebi, the only one among these princes who was descended from the reigning dynasty of the Seljuks, led the life of a pirate at Sinope and Heraclea on the Black Sea. Another tribe, which had lately arrived in these western countries, had subdued Galatia and Bithynia: this was the tribe of the Turks-Osmanlis.

Turks-Osmanlis.—Soliman-Shah, the son of Kay-alp, the chief of the tribe of the Káyi, lived in the environs of Mahán in Khorásán in the beginning of the seventh century A.H. (the thirteenth A.D.). He fled before the approach of Genghis-Khan, in A.H. 621 (A.D. 1234), and settled with 50,000 of his men in Erzenján and Akhláth in Armenia. Seven years later, after Khorásán and Khowárezm had been conquered by 'Alá-ed-dín, the sultan of the Seljuks in Koniah, Soliman returned to the steppes of his native country. Crossing the Euphrates near Ja'ber, he was drowned in that river, and his tribe erected a tomb to his memory, which still exists, and has the name of 'Turk-mesárí,' or the 'Tomb of the Turk.' One part of his tribe continued their march to Khorásán; another, commanded by Ertoghrul, 'the upright or the brave man,' one of the four sons of Soliman, resolved to remain in the western countries, and to settle there under the protection of 'Alá-ed-dín, the sultan of Koniah. On their march to the west, they saw in a plain two armies preparing for battle: one of them was numerous, the other feeble, but of warlike appearance. Without hesitating, Ertoghrul resolved to assist the feeble. It was the army of 'Alá-ed-dín going to fight with the Mongols; and with Ertoghrul's assistance the Seljuks gained the day. 'Alá-ed-din rewarded Ertoghrul with a dress of honour, and gave him and his tribe the fertile pasture-grounds of Tumanij, Ermeni, and Sogud, or, according to some, the Mountains of Káraja-dagh near Angora. Ertoghrul assisted the sultan in all his wars with the Greeks and the Mongols, and afterwards received the district of Sultan-öné, on the frontiers of the dominions of 'Ala'-ed-dín and the Byzantine empire, as a fief, on condition of defending the frontiers against the invasions of the Byzantines. Ertoghrul died in A.H. 687. (A.D. 1288). His successor as chief of the tribe was his son Osman.

Osman (A.H. 687 till 726; A.D. 1288 till 1326) was the founder of the Turkish empire; he is the ancestor of the reigning dynasty; and he has given his name to a numerous and powerful nation. The divine origin of prophets and the future grandeur of heroes are often announced to the nations of the East by dreams and visions. Ertoghrul dreamed that his house would rise to power. Osman dreamed that a tree grew from his lap and overshadowed the earth. This was explained to mean, his descendents should rule over the world; and as the Korán says that 'good dreams come from God,' the warriors of his tribe joyfully shed their blood to prove the truth of the words of their prophet. During the life of his father, Osman had signalized himself as a virtuous youth and an intrepid warrior. Accompanied by a chosen band of 'alper' (that is, strong and gallant men, the plural of 'alp,' 'strong'), he was the dread of the Greeks and the Mongols of Persia. Osman, and the three bravest of his companions, Konur-alp, Torghud-alp, and Aïghud-alp, appear in Turkish history like King Arthur and his knights, or Charlemagne and his paladins. They took by storm the strong fortress of Melangena, which received the Turkish name of Kárá-hissar, or the 'black castle,' and Osman was invested with it as a fief by Sultan 'Alá-ed-dín (A.H. 688, A.D. 1289). His power grew gradually by conquests from the Greeks, and afterwards from some petty Seljukian princes of Asia Minor, especially by the conquest of Brusa in A.H. 717 (A.D. 1317). In A.H. 722 (A.D. 1321) the first Turks-Osmanlis crossed the Bosporus and appeared in sight of Constantinople, two similar expeditions having previously been made by the Seljuks, in A.H. 662 (A,D. 1263) and in A.H. 708 (A.D. 1308). At his death, which took place in A.H. 726 (A.D. 1326), he left to his successor, Urkhan, a state which comprehended a considerable part of Bithynia in the north, Galatia in the east, and Phrygia in the south, the western frontiers of which were the river Sangarius and its southern tributary, the Thymbrius. This state, after Sultan 'Alá-ed-dín had been killed by the Mongols in A.H. 707 (A.D. 1307) became almost independent. The name Osman is of Arabic origin (othmán), and signifies literally 'the bone-breaker;' but it also designates a species of large vulture usually called 'the royal vulture,' and in this latter acceptation it was given to the son of Ertoghrul.

Urkhan (A.H. 726 till 761; A.D. 1326 till 1359) was the successor of Osman, and his eldest son. His reign was signalised by conquests, and by some political and military institutions which have been the groundwork of the Turkish constitution until our days. His brother 'Alá-ed-dín, a prince distinguished by the modesty of his character and by his faithful devotion to Urkhan, was his prime-minister, the first grand-vizír mentioned in the Turkish annals. 'Alá-ed-dín made wise laws concerning the dress of the people and the mint: the first coins of the Osmanlis date from the reign of Urkhan. By his advice Urkhan ordered the 'khotbah,' or the public prayer, to be said in his name, which had formerly been pronounced in the name of the sultan of Koniah. Thus by coining money bearing his name, and by the 'khotbah' being said in his name, Urkhan assumed two prerogatives which, according to the Islám, constitute the privilege of majesty. His vassalage to Koniah was abolished, and the state of the Turks-Osmanlis became an independent empire. To secure the rising power of his brother, 'Alá-ed-dín, assisted by the high judge Kára Khalíl Chenderelí, established a standing army long before any such thing was known in Europe. This was the famous body of the Janizaries, a word mutilated by Europeans from the Turkish 'Yeñi-cheri,' or 'the new troop.' [JANIZARIES.] (*Biographical Dictionary*, ''Alá-ed-dín.') The new troops decided the victory in the battle of Philocrene, where the emperor Andronicus the Younger was entirely defeated by Urkhan and 'Alá-ed-dín, and compelled to cross the Bosporus, and to take refuge under the walls of Constantinople (A.H. 731; A.D. 1330). The conquest of Nicæa, once the residence of Greek emperors [THEODORUS LASCARIS], was the fruit of this victory; and six years afterwards the rest of Bithynia and the greater part of Mysia (Kárási) fell into the hands of the Turks. Nicæa became the residence of Urkhan, the Greek convents were occupied by Mohammedan derwishes, and Mollah Khosrew, Wási 'Alí, and other Turkish poets composed their elegies on the solitudes of Mount Olympus. During this time the Turks had thrice crossed the Bosporus and the Dardanelles, and the emperor Andronicus was compelled to surrender his provinces in Asia which had been conquered by Urkhan. This peace, the first which was made between the Osmanlis and the Greeks, was concluded in A.H. 734 (A.D. 1333). But as early as A.H. 738 (A.D. 1337) a strong body of Osmanlis again crossed the Bosporus, commanded by Urkhan, who was the first Turkish sultan that ever put his foot on the soil of Europe. He repeated his expeditions, which had rather a predatory character, in the following years, till at last the emperor John Cantacuzenus (A.D. 1341-1355) reconciled Urkhan by giving him his daughter in marriage (A.H. 747; A.D. 1346). Urkhan was then sixty years old. Notwithstanding his relationship to the emperor, he continued hostilities; and in A.H. 756* (A.D. 1354) his son Soliman crossed the Dardanelles with a few troops, and surprised the castle of Tzympe, now Chini, near Gallipoli, which from that time remained in the hands of the Turks, who were thus settled in Europe. During the civil troubles between the emperor John Cantacuzenus and his son-in-law John Palæologus, Urkhan assisted the emperor, and seized the castle of Gallipoli, the key of the Dardanelles, in which he maintained himself after the abdication of John Cantacuzenus against the troops of the emperor John Palæologus. The conquest of Gallipoli was an event so important, that Urkhan announced it by pompous letters to the petty Seljukian princes of Asia Minor. Urkhan died in A.H. 761 (A.D. 1359), at the age of seventy-five years. His empire was divided into several provinces, which were governed by pashas. This word, which comes from the Persian 'paï-shah,' or 'the foot of the Shah,' is of very antient origin. In the remotest times the ministers of the kings of Persia were called his feet, his hands, his eyes, his ears (Xenophon, *Cyrop.*, viii., c. 2, 10), and his tongue. The title of 'paï-shah' was principally given to the governors of the provinces who were also commanders-in-chief of the troops of their province, and the chief support ('the feet') of the king. The Turks adopted the title of pasha as early as the reign of Osman. However, it was at first given to scholars and poets; and the first pashas we find in Turkish history were Mukhliss-Pasha (the sincere pasha), formerly known by the name of 'Arif-bi-llah, and his son 'Ashik-Pasha (the loving pasha), the author of a poem on divine love, upon whom this title was conferred by Osman. Urkhan was succeeded by his younger son Mürad, the elder, Soliman, having lost his life by a fall from his horse.

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* Hammer, vol. i., p. 145, says A.H. 758 (A.D. 1356). But Tzympe was conquered before Gallipoli, and both the castles were lost a short time before the abdication of John Cantacuzenus, in the month of January, 1355.

Mürad I., or Amürad I. (A.H. 761 till 791; A.D. 1359 till 1389). No sooner was Mürad on the throne than he formed the plan of conquering the remaining part of the Byzantine empire in Europe, and of subduing the Seljukian princes in Asia Minor. As early as A.H. 763 (A.D. 1361) he took Adrianople, the second capital of the Byzantine empire, which he afterwards chose for his residence. In the following year he conquered Philippoli, and the terror of the Turkish name spread over Europe. Pope Urban V. preached a crusade against them; and the kings of Hungary, Bosnia, Servia, and the prince of Wallachia formed a league against Mürad. They crossed the Hæmus (the Balkan) with their combined forces; but before they had seen the towers of Adrianople they were totally defeated by the Turks, and king Louis of Hungary narrowly escaped captivity (A.H. 765 or 766; A.D. 1363). This was the first battle fought between the Osmanlis and the European princes. In memory of his happy escape king Louis founded the abbey of Mariazell, in the Alps of Styria, which is still one of the most famous places of pilgrimage in Germany. After this victory, the greater part of Thrace, Bulgaria, and parts of Macedonia, Thessaly, and Epirus fell into the hands of the victors. Turkish soldiers appeared at Apollonia, where Augustus was staying when he was informed of the assassination of the dictator Cæsar. In A.H. 788 (A.D. 1386) Mürad carried his arms into Asia, and defeated 'Alá-ed-dín, the Seljukian prince of Karamania, who was compelled to take the oath of vassalage. The result of this battle, which was fought in the plain of Koniah, was principally due to the irresistible charges of Bayazid, the son, and afterwards the successor, of Mürad. Meanwhile Lazarus, the kral or king of Servia, who had recovered from his defeat, prepared an attack on the Turkish dominions, assisted by strong bodies of Bosniak, Bulgarian, Hungarian, Polish, and Wallachian auxiliaries. Although his army was twice as numerous as that of the Turks, he was attacked by Mürad on 'the field of the Ousels,' near Kossova, in the southern corner of Servia (A.H. 791; A.D. 1389). The Servians were at first victorious; but prince Bayazid, armed with an iron club, broke their phalanx, and they were routed with dreadful slaughter: their king Lazarus was made a prisoner. Mürad received the principal captives in his tent. Milosh Kobilowich, a noble Servian, prostrated himself before the throne, and kissed the feet of the victor: but suddenly he seized a dagger, which was hidden under his clothes, and stabbed Mürad to the heart. Mürad ordered king Lazarus to be beheaded in his presence, and then expired on his throne. The famous battle on the field of the Ousels, and its consequence, the vassalage of Servia, became a subject for the national songs of the Servians, a collection of which has lately been translated into almost all European languages. During the reign of Mürad I., the feudal system, an old Turkish institution, was developed and strengthened by several regulations, principally concerning the small military fiefs, or 'Timar,' and the great military fiefs, or 'Siamet.'

Sultan Bayazid I. (from A.H. 791 till 805; A.D. 1389-1403), the eldest son of Mürad I., was the first chief of the Osmanlis who assumed the title of Sultan. His first act was an order by which his youngest brother Yakub was put to death, a crime which he justified with the words of the Korán, that 'death is better than uproar;' from which we may conclude that Yakub had perhaps formed some ambitious plan. Bayazid, already known as a general, and who, for the rapidity of his manœuvres and the impetuosity of his charges, deserved the surname of 'Ilderim,' or the 'lightning,' successfully pursued the career of conquests opened by his ancestors. The emperor Manuel Palæologus, who, of the immense empire of his ancestors, possessed little more than the city of Constantinople, refused or was unable to pay the heavy tribute due to the Turks in consequence of a treaty concluded between him and Bayazid. The Sultan immediately laid siege to Constantinople, the first siege of this city by the Turks (A.H. 794; A.D. 1391); but a fleet with a body of French knights, commanded by Boucicault (the author of the 'Mémoires'), reached Constantinople, and saved the capital. The siege however was changed into a blockade, which lasted for seven years. In Asia Bayazid conquered the extensive state of Karamania, and the Seljukian principalities of Kastemuni, Janik, and Amasia. During this Sigismund, king of Hungary, had levied a strong army, with the view of driving the Turks back to Asia, and he was reinforced by a body of French troops, commanded by John of Burgundy, Count of Nevers, and the flower of the French chivalry. But this powerful host was annihilated in the battle of Nikipoli (A.H. 799; A.D. 1396). Sixty thousand Turks covered the field, and Bayazid, to avenge this massacre and the death of two thousand Turkish captives, cut to pieces by the French some days before, ordered the slaughter of the Christian captives. Ten thousand of them were put to death, but the noblest prisoners, among whom were John of Burgundy, De Coucy, De la Tremouille, and several other knights belonging either to the royal house or to the first nobility of France, were sent to Gallipoli, where they remained until the following year, when they were ransomed by the kings of France, of Cyprus, and of Hungary. King Sigismund was pursued by the victorious Turks, who, one hundred and seventy years after their ancestors had left the pasture-grounds of Khorásán, made their first incursion into the south-eastern provinces of Germany. Bayazid, leaving the prosecution of the Hungarian war to his generals, turned his arms against Greece, which he overran in one campaign (in A.H. 800; A.D. 1397). In the same year his general, Timur-Tash, extended his dominions in Asia as far as the Euphrates. Bayazid was preparing an invasion of Hungary, when he was compelled to defend Asia against the conqueror of the East, Timur. His wars with Timur, his captivity in the battle of Angora, and his death in the camp of his victor, have been told under TIMUR. During the reign of Bayazid I., the administration of justice was regulated by various laws, among which there is one by which court-fees were introduced into Turkey.

Interregnum (A.H. 804 till 816; A.D. 1402 till 1413).

After the battle of Angora, Timur reinstated the Seljukian princes of Karamania, Aïdin, Menteshe, Tekke, and Kermian, who had been deprived of their dominions. However after Timur's death (A.H. 807; A.D. 1405) wars broke out among these princes, each of whom aimed at the possession of the antient empire of the Seljuks. In the meantime the throne of Osman had become vacant by the death of Bayazid, and the succession was disputed among three of his sons, Soliman, Isa (Jesus), and Mohammed. Soliman from the moment of the death of his father was independent in Europe, and Isa and Mohammed found adherents enough to defeat the Seljukian princes and to recover each a part of the vast dominions of their father. Thus Isa became independent at Brusa, and Mohammed at Amasia. Thrice defeated by his brother Mohammed, Isa fled to Karamania, and was heard of no more; perhaps he was beheaded by order either of Mohammed or Soliman. Another son of Bayazid, Musa, who, until then, had not aimed at independence, was appointed by Mohammed to attack Soliman, who was acknowledged by the Byzantine court as the only legitimate Sultan. Musa crossed the Dardanelles in A.H. 809 (A.D. 1406), and after various chances surprised Soliman in A.H. 813 (A.D. 1410). Soliman, forsaken by his officers, fled to Constantinople, but was killed on his way in the village of Dugunjí, and Musa became master of the Turks in Europe. War now broke out between Musa and Mohammed, who, having allied himself with Stephen, the vassal king of Servia, crossed the Dardanelles. On the plain of Chámurlí, near the sources of the Kárá-su, towards the southern frontiers of Servia, Musa, forsaken by his best troops and generals, was entirely defeated, in A.H. 816 (A.D. 1413). The unfortunate prince escaped from the field of battle, but his pursuers found him dead (?) in a morass. In consequence of this victory Mohammed became sole Sultan.

Sultan Mohammed I. (A.H. 816 till 824; A.D. 1413 till 1421). Mohammed I., gifted by nature with beauty, strength courage, and talents, which advantages had been improved by a careful education, was called by his countrymen 'Kürishjí Chelebi,' or 'the gentleman.' He was a worthy descendant of Osman; but, less humane than his ancestor, he ordered the murder of his nephew, the son of his late brother Soliman. The reign of Mohammed was short, but eventful.

From the field of Chámurlí he hastened to Asia, and in two years expelled the Seljukian princes of Karamania and other parts. He was less fortunate against the Venetians, whose admiral, Loredano, destroyed a Turkish fleet off Gallipoli, in A.H. 819 (A.D. 1416); but peace was concluded in the same year, and a Turkish ambassador appeared at Venice. In the same year a Turkish army, which had made an expedition into Germany, was destroyed at Radkersburg in Styria. But Mohammed quelled a dangerous plot of fanatic derwishes, or monks, which had led to a religious war; and he succeeded, by negotiations, as well as by force, in compelling the emperor Manuel Palæologus to keep in prison a certain Mustafa, who was called Mustafa the Impostor, but who was most probably that prince Mustafa, son of Bayazid and brother of Mohammed, who had disappeared after the battle of Angora. [TIMUR.] In A.H. 824 (A.D. 1421) the Sultan paid a visit to the emperor Manuel in Constantinople, where he was received with extraordinary splendour. He died in the same year, and left to his successor, Mürad II., an empire of greater extent than that of his father Bayazid before the invasion of Timur.

Sultan Mürad II. (A.H. 824 till 855; A.D. 1421 till 1451), the third son of Mohammed I., was a youth of eighteen when he ascended the throne. Immediately after the death of Mohammed, Mustafa was released from his captivity at Constantinople, and disputed the throne with Mürad, who defeated and killed his rival with the assistance of Adorno, Doge of Venice, and commander of the Venetian fleet then assembled in the sea of Marmara. The following years of the reign of Mürad II. were signalised by some conquests in Greece, by the conquest of Thessalonica, by a siege of Constantinople, as well as by serious contests with some rebellious khans in Asia, and with Wlad Drakul the Cruel, prince of Wallachia. A Polish embassy appeared at Adrianople in A.H. 844 (A.D. 1440). In A.H. 846 (A.D. 1442) Mürad was involved in a war with Ladislaus, king of Hungary, whose general, John Hunyad, defeated the Turks at Nissa in the following year, and penetrated as far as Philippopoli, whence, laden with booty, he led his army back to Hungary. This war, though interrupted by a peace (A.H. 848; A.D. 1444), was afterwards continued, and proved most fatal to the Hungarians. Mürad was a lover of peace and philosophical studies. The peace with Hungary having been sworn with solemn oaths on the Korán and on the Evangelists, the sultan was persuaded that there was no danger on the side of Hungary; and the state of Asia being satisfactory, he retired into Asia, renouncing the throne in favour of his son Mohammed, then a child. But Cardinal Julian Cesarini, the instigator of the war between Ladislaus and Mürad, who was dissatisfied with the peace, persuaded Ladislaus and Hunyad to break it, and he released them from their oath. Ten weeks after the treaty had been sworn, the Hungarian army entered Turkey. Upon this news Mürad left his solitude, and with forty thousand men crossed the Bosporus, the Dardanelles being watched by a Venetian fleet. At Varna he met with the enemy, feeble in number, but so presumptuous that they boasted they would expel the Turks from Europe in the course of that year (A.H. 848; A.D. 1444). The Hungarians were entirely defeated; Hunyad saved himself by a hasty flight, but king Ladislaus, the Cardinal Julian, and several other Christians of high rank were killed. During the battle, a copy of the broken treaty, attached to the top of a lance, was carried through the lines of the Osmanlis, to remind them that they were fighting for a just cause. After this victory Mürad renounced the throne a second time, but was again obliged to take the reins of government by a mutiny of the Janizaries, which however he soon quelled. The latter years of his reign were as glorious as the beginning. Corinth and Patras were conquered, and Hunyad, having again invaded Turkey, was routed at Kossova, in A.H. 852 (A.D. 1448). Mürad was less fortunate against the famous Scanderbeg, the prince of Epirus, who maintained himself in his principality in spite of all the efforts of the Sultan. Mürad, who died in A.H. 855 (A.D. 1451), has been compared with Diocletian and Charles V., who both renounced the throne. But these two emperors retired from the world becase they were disgusted with the cares of government; Mürad loved power, but he loved still more the quiet of a private life.

Sultan Mohammed II., the son of Mürad II. (A.H. 855 till 886; A.D. 1451 till 1481), was a youth of twenty-one when he ascended the throne. His reign is memorable in the annals of Turkish as well as European history for the conquest of Constantinople. The power of the last Greek emperors was insignificant, but their intrigues against the Sultans were troublesome and often dangerous, and the mere fact of their existence was a cause that prevented the numerous Greek subjects of the Sultans from obeying the Turkish sceptre. The name of Constantinople was pronounced in the East with no less reverence than that of Baghdád; the city was the natural capital of any empire situated on both sides of the Bosporus; and residing in the palace of the successors of Constantine, the Sultans could consider themselves as the heirs of a thousand years' authority exercised by the emperors over the nations of the East. Constantinople fell after a siege of fifty-three days, on the 21st of Jemázíul-ewwal, A.H. 857 (29th of May, 1453), and the last of the Greek emperors, Constantine Palæologus, died under the swords of the Janizaries. Constantinople became the capital of the Sultans, and from this time Turkish history becomes intimately connected with the history of Europe.

Mohammed now began a series of victories and conquests, by which his empire became one of the most powerful states in the world. Servia, formerly a vassal state, became a Turkish province; the Peloponnesus was conquered, but it was afterwards lost; Franco Acciajuoli, the last duke of Athens, once the friend of Mohammed, was strangled; Trebizond, the last remnant of Greek independence, was also taken [TREBIZOND]; Kaffa was captured by the famous grand-vizir Ahmed Kedük, and the khans of Crimea took the oath of vassalage. In Asia the frontiers of Turkey were extended by the victories obtained over several petty Seljukian princes, and Europe was alarmed at the incursions of the Turks into Wallachia, Moldavia, Transylvania, Hungary, and Germany. But more dangerous than all this was the fall of Otranto in Italy, which was taken by Ahmed Kedük, in A.H. 884 (A.D. 1479). Scanderbeg was defeated, and his dominions, Epirus and the Herzogevina, were united with Turkey. Mohammed II. died in A.H. 886 (A.D. 1481): his successor was his son Bayazid II. During the reign of Mohammed II. great numbers of Turks settled in Europe, where they received lands which had been taken from the Greeks. Mohammed was very active in the administration of his empire. Among his criminal laws we find one by which blood-money was established, that is, the price for wounds, broken limbs, and the whole body in case of manslaughter, by paying which the perpetrator was discharged from further liability. This blood-money corresponds to the 'Wehre' of the antient Teutonic nations, with this difference however, that among these nations it was the wounded person, or his heirs, who received the money as an indemnification, while in Turkey the Sultan received it. The blood-money was therefore a punishment, and not a mere satisfaction, like the 'Wehre.' By a bloody and inhuman law Mohammed II. declared that the Sultan had the power to put his brothers to death in order to prevent troubles. (Gottlob Becker, *Dissertatio Politica de Parricidio Osmanidarum*, Wittenberg, 1664.) However this law was not without precedents and analogies, though only exceptional, and none of them had been sanctioned by a law. Among the Persians the murder of parents and relations by the kings was common in the remotest times. Mohammed was very careful in establishing schools and academies for the study of theology, jurisprudence, mathematics, and philosophy.

Sultan Bayazid II., the son of Mahommed II. (A.H. 886 to 918; A.D. 1481 to 1512). Bayazid having only one brother, Jem, did not avail himself of his power to put him to death. The consequence was, a rebellion of Jem, who disputed the crown with his brother: after a long civil war, Jem was at last obliged to fly to Rhodes. The Knights of St. John sent him a prisoner to France, whence he went to Italy, and there he died in A.H. 900 (A.D. 1494), poisoned by Pope Alexander VI., Borgia. Besides these civil commotions, the reign of Bayazid was troubled by wars with Egypt, Venice, Hungary, Poland, and Austria. In A.H.

901 (A.D. 1495) the first Russian ambassador appeared at Constantinople. Bayazid towards the end of his life experienced the bitterness of a war with his youngest son, Selím, who rose in rebellion because Ahmed, the third and favourite son of Bayazid, had been proclaimed his successor. Selím was at first defeated, but the Sultan was obliged to divide his forces by sending an army to Asia against the rebel Sheitán-kuli. Sheitán-kuli was defeated by the famous grand-vizír 'Ali Makhdum Pasha, but the rebel as well as the grand-vizír lost their lives in the battle. Deprived of his best general, and exposed to a dangerous mutiny of the Janizaries, Bayazid was compelled by Selím to abdicate, and he died soon afterwards, either of grief or from poison by order of Selím (A.H. 918; A.D. 1512). The reign of Bayazid II. was generally unhappy, and the limits of the empire were not extended by him; but he lost none of the conquests of his predecessors.

Sultan Selím I., the son of Bayazid II. (A.H. 918 to 926; A.D. 1512 to 1520). The short reign of this cruel, but most active and gallant Sultan, is one of the most glorious in Turkish history. Immediately on his accession he put to death his brother Korkud and five of his nephews. He then marched against his brother Ahmed, whom he defeated, seized, and murdered, in A.H. 919 (A.D. 1513). In a war with Persia, Selím, after having routed Shah Isma'íl in a decisive battle, took Tabríz in A.H. 920 (A.D. 1514). After this victory he attacked 'Alá-ed-dewlet, of the dynasty of Zúlkadr, who resided at Mer'ash, and who reigned over the extensive country between Armenia, Kurdistán, Syria, and Karamania. 'Alá-ed-dewlet was defeated and lost his life, in A.H. 921 (A.D. 1515): his dominions were united to Turkey. The third and most important conquest was that of Egypt, including Syria, which had been governed since A.H. 922 (A.D. 1516) by Sultan Tumán-Bey, of the second dynasty of the Mamluks. Selím conquered Syria in the month of December, 1516, and in the beginning of the following year (Zilhije, 922; January, 1517) he defeated the army of Tumán-Bey in the plain of Ridania, not far from Cairo. Shortly afterwards Tumán-Bey was made prisoner, and hanged by order of Selím, who was now master of all Egypt, which from that time remained a province of Turkey. Al-mutawakkel, the last khalif of Cairo, was deposed from his rank as chief of the believers, and Selím was acknowledged as his successor by Mohammed Abú-l-Berekiat, the sherif of Mecca, who presented him with the keys of the Ka'bah. Selím returned to Constantinople in the same year, and arrived there with one thousand camels laden with the spoil of Egypt. He died in A.H. 926 (A.D. 1520), in consequence of his passion for taking opium. One of his last acts was the creation of a powerful navy. Selím, a zealous Sunnite, resolved to exterminate the heretical Shiites who lived in his empire, and great numbers of whom were put to death. He also resolved to kill all the Christians who would not adopt the Mahommedan religion; but he was prevented by his ministers, who besought him not to violate the Korán, which commands toleration with regard to all those non-believers who pay the capitation-tax, that is, who are quiet subjects.

Sultan Soliman, or Suleiman I., surnamed the Great, the son of Selim I. (A.H. 926 till 974; A.D. 1520 till 1566). This Sultan is called Soliman II. by several historians, who give the title of sultan to Soliman, the son of Bayazid I., and the brother of Mohammed I. Soliman I. is the greatest sultan of the Osmanlis, and his reign is the most important period of Turkish history. During his life Turkey was at the summit of her power, and by his conquests, his laws, his character, and his splendour, he has justly deserved the title of 'the Great' given to him by Europeans. The Turks, more modest, only call him the 'Legislator.' In the first year of his reign he took Belgrade, the key of Hungary, and Rhodes, which was defended by the Knights of St. John; and he compelled Radul, the prince of Wallachia, to acknowledge himself a vassal of the sultan. In A.H. 932 (A.D. 1526) Louis, king of Hungary, lost his life in the battle of Mohacs, againt Soliman, who overran Hungary in one campaign, and took the capital, Buda. The crown of Hungary was disputed between Ferdinand of Austria, king of the Romans, and Zapolya, the waiwode of Transylvania, who promised to take the oath of vassalage if the Sultan would aid him against Ferdinand. Soliman agreed to the proposal, re-entered Hungary in A.H. 935 (A.D. 1529), penetrated into Germany, and laid siege to Vienna in the month of Moharrem (September) of the same year. But he was compelled to raise the siege, and in A.H. 940 (A.D. 1533) he concluded peace with Ferdinand, who recognised Zapolya as king of Hungary and prince of Transylvania. From Hungary Soliman proceeded to Persia, then governed by Shah Thamasp, who had protected Sherif-Bey, the khan of Bedlis, who had revolted against the Sultan. This war lasted till A.H. 961 (A.D. 1554); and although the Turks took Baghdád, Soliman gave up his conquests on condition of the Shah not aiding the rebellious subjects of the Sultan.

While one Turkish army was thus occupied against Persia, another, supported by a fleet, made war against the Venetians, who lost several of their islands in the Archipelago; and with a third army Soliman again took the field against Ferdinand of Austria. Zapolya having died in A.D. 1539, Ferdinand seized the kingdom of Hungary during the absence of Soliman in Asia; but the Sultan invaded Hungary in A.H. 948 (A.D. 1541). In this war Soliman was victorious over the best captains of Ferdinand and his brother, the emperor Charles V.; and Ferdinand was compelled to cede to Soliman the greater part of Hungary, with the capital, Buda or Ofen, by a treaty concluded in A.H. 954 (A.D. 1547). In two years fresh hostilities broke out, and after a long war, during which Hungary and some adjacent parts of Germany were dreadfully ravaged, a new peace was concluded in A.H. 970 (A.D. 1562), by which Soliman maintained possession of his conquests, and Ferdinand, then emperor, promised to pay an annual tribute of 30,000 ducats for his part of Hungary (Upper-Hungary). Previously to this the domestic peace of Turkey was disturbed by a civil war between Selím and Bayazid, sons of Soliman, who disputed the future succession to the throne during the lifetime of their father. After the loss of the battle of Koniah, Bayazid with his four sons fled to Persia, and Soliman having declared himself for Selím, the Shah delivered the fugitives to the messengers of the Sultan. Bayazid and his sons were put to death in A.H. 969 (A.D. 1561).

During the reign of Soliman the Turkish navy was the first in the world, and became the scourge of the Mediterranean. Piale, Torghud, and Salih ravaged the coasts of Italy, Spain, and Africa: they took Reggio, Sorento, Bujia, Oran, and the island of Majorca; and in A.H. 967 (A.D. 1560) Piale defeated the united fleets of Spain and Italy off Jerba, an island on the coast of Africa within the limits of Tunis. Another Turkish fleet in the Red Sea and in the Persian Gulf was successively commanded by Piri Reis, Mürad, and Sidi 'Ali. Piri Reis sailed along the whole coast of Arabia from Suez to Basrah, and on his way he took the town of Muscat. This Piri Reis was the author of the 'Bahriye,' a map of charts of the greater part of the coasts of the Mediterranean. Sidi 'Ali appeared at Diu and Surat: he fought several times with the Portuguese in the Indian Sea, but having lost his ships by storms and by the superiority of the Portuguese, he returned by land from the mouth of the Indus to Constantinople. He wrote on the use of the astrolabe, and is the author of 'Muhit' (the Ocean), a very good description of the Indian Sea. After the victory at Jerba, Soliman resolved upon the conquest of Malta, and a powerful fleet left Constantinople for that purpose in the beginning of the year A.H. 973 (A.D. 1565). But the expedition failed; and after immense losses of men the fleet returned to Constantinople, after a siege of five months. [MALTA, p. 347.] During this time the war with Austria was renewed. Soliman, notwithstanding his old age, took the command of his army and hastened to Hungary. He laid siege to Szigeth, defended by Zriny, and he died there in his camp in the month of Safer, 974 (September, 1566), before the fortress had fallen into the hands of the besiegers.

Poetry, arts, and science flourished during the reign of Soliman. The body of the ulemas received a new organization, and great privileges in matters relating to their property.

Notwithstanding the continual wars and the great liberality of Soliman, the finances were in a flourishing state, and he was only once obliged to raise an extraordinary poll-tax. Tho payment of the Janissaries was augmented, the succession to military fiefs was regulated, and so was the administration of the extensive domains of the Sultan in Egypt; several edicts were issued to ameliorate the condition and to determine the taxes of the Rayas; and the criminal code was revised, and enlarged by severe laws concerning the life, honour, and property of the Osmanlis, the Rayas, and even the slaves. Under Soliman the use of coffee became general in Turkey.

Notwithstanding all this, the decline of the Turkish empire begins with the reign of Soliman the Great. Kochi-Bey, who is sometimes called 'the Montesquieu of the Turks,' attributes the decline to the following causes:—1, Soliman, always at the head of his armies, abandoned the direction of state affairs entirely to the diwan, over which he seldom presided; and thus the grand-vizír acquired too much power; 2, the influence of the harem gave way to petty intrigues, and continued so during the reign of his successors; 3, the administration of the provinces and of the domains was often farmed to Jews, Greeks, and others, who impoverished the subjects though they filled the imperial treasury; 4, nepotism was sensibly felt; 5, luxury, introduced by the great, who had enriched themselves with the spoil of so many countries, spread through all classes, and found its way into the army. We add, as a sixth cause, that the army became more eager to plunder than to gain victories.

Sultan Selím II., the son of Soliman the Great (A.H. 974 till 982; A.D. 1566 till 1574). Immediately after his accession he quelled a dangerous mutiny of the Janizaries, whereupon he concluded peace with the emperor Maximilian II., by which each remained in possession of his share of Hungary as fixed by the peace of A.H. 970 (A.D. 1562). Turkey was increased by the province of Yemen in Arabia, which was conquered by Sinán-Pasha in A.H. 977 (A.D. 1570); by the addition of Cyprus, taken from the Venetians in the same year by Lálá Mustapha Pasha, Piale, and 'Ali-Moezzin, in spite of the peace which had been sworn by the Sultan; and by the acquisition of Tunis, which was taken from the Spaniards in A.H. 982 (A.D. 1574). The Turkish navy, commanded by 'Ali Moezzin, was almost annihilated by Don Juan d'Austria, in the battle of Lepanto, in A.H. 980 (A.D. 1572); but the Sultan, and especially his grand-vizír Sokolli, and his admiral Ochiali, displayed such activity in rebuilding new ships, that in two years the Turkish navy was superior to the united fleets of the Christian governments on the coasts of the Mediterranean. By order of Selím, an attempt was made to join the Don and the Wolga by a canal, some traces of which are still visible.

Sultan Mürad III., or Amürad III., son of Sultan Selím II. (A.H. 982 till 1003; A.D. 1574 till 1595). Although this sultan was governed by favourites and by women, Turkey was enlarged during his reign by some important conquests. A war having broken out with Persia, the Turks, after a victory at Childir, conquered Eriwán, Georgia, and Daghistán. From this country, Osman Pasha, the commander of a part of the Turkish army, proceeded northwards, and crossed the Caucasus in order to relieve the khan of the Crimea, who had been attacked by the Russians. In A.H. 992 (A.D. 1584) he returned to Constantinople, taking his way through Southern Russia and Bessarabia, and arrived in the capital after having carried the crescent round the Black Sea. The following years of Mürad's reign were signalized by a fresh war with Persia, and by dangerous troubles among the Druses in Mount Lebanon, in Egypt, and in Arabia. Transylvania, Moldavia, and Wallachia refused to pay the annual tribute, and as they were encouraged to resistance by Austrian agents, the Turks invaded the Austrian territory. War was declared, but Sultan Mürad died before it was concluded. Mürad III. had a hundred and two children. During his reign, Turkey had diplomatic relations with almost all the nations of Europe: Edward Berton concluded a commercial treaty between England and Turkey. On the death of Mürad III. the Turkish empire contained in Europe the present European Turkey, Greece, and the greater part of Hungary; in Asia, all Asia Minor, Armenia, Georgia, Daghistán, the western part of Kurdistán, Mesopotamia, Baghdád, Syria, Cyprus, and the greater part of Arabia; in Africa, Egypt, Algiers, Tunis, and Tripoli. The following were vassal states:—the khanat of the Crimea; the principalities of Transylvania, Moldavia, and Wallachia, and the republic of Ragusa. The Byzantine empire under Justinian was of less extent than Turkey at the close of the sixteenth century, and since the time of the Franks and Goths no name had inspired such universal terror as that of the Turks.

Sultan Mohammed III., son of Mürad III. (A.H. 1003 to 1012; A.D. 1595 to 1603). He secured his succession by putting to death his nineteen brothers, and seven female slaves of his father who were pregnant. The war with Austria continued during his whole reign; the Austrians were unable to drive the Turks out of Hungary, and the Turks did not succeed in expelling the Austrians. His relations with the other European powers were generally peaceful. Sigismund, prince of Transylvania, who had taken arms against the Porte, submitted to the Sultan, and was invested with his principality as a vassal of Turkey. Towards the end of the reign of Mohammed, Deli-Husein rebelled in Asia, and was the cause of thirty years' troubles and civil war.

Sultan Ahmed I., the son of Mohammed III. (A.H. 1012 to 1026; A.D. 1603 to 1617), ascended the throne when he was a boy of fourteen. The rebels in Asia having been supported by Shah Abbás the Great, of Persia, a war broke out between him and the Sultan; which lasted till A.H. 1022 (A.D. 1613), although it was interrupted by some short truces. In this war the Turkish soldiers fought with their usual courage, but their discipline was loose, and the commander of their enemies, Shah Abbás, was the best general in the East. Ahmed was compelled to cede to the victor Daghistán, Georgia, and Eriwán, and the Shah promised not to aid the rebels in Asia. Abbás however did not keep his word, and the rebellion that had begun under Mohammed III. continued to disturb the peace of Asia Minor. The Turkish commanders in Hungary were no less unfortunate. The emperor Rudolph II. was assisted by the princes of the empire; their troops defeated the Turks in several bloody battles, and Ahmed was obliged to conclude the peace of Sitvatorok (A.H. 1015; A.D. 1606). This peace must be considered as the first trace of an international law between Turkey and the European powers. The Sultan recognised the emperor as his equal by giving him the title of 'Padishah;' the tribute which Austria had paid for her part of Hungary was abolished; and the Sultan promised not to assist the insurgents in Hungary, who had taken arms against the emperor under the pretext of obtaining religious liberty. Ahmed concluded a commercial treaty with the United States of the Netherlands. During his reign a body of Cossacks descended the Don in a fleet of boats, crossed the Black Sea, and surprised the town of Sinope, which they plundered and destroyed. The relations with Poland were hostile, but the treaty of Bussa prevented war. Turkey was still a powerful state, but her gradual dissolution became apparent during the reign of a weak prince who was governed by favourites and women.

Sultan Mustafa I., the brother of Ahmed, ascended the throne in A.H. 1026 (A.D. 1617), and descended from it in six months, in the beginning of A.H. 1027 (A.D. 1618) in consequence of a revolution in the seraglio. He was confined to a prison, and his successor was his nephew.

Sultan Osman II., the son of Ahmed I. (A.H. 1027 till 1031; A.D. 1618 till 1622). A short but unhappy war with Poland was the most remarkable event of the reign of this prince, who soon incurred the hatred of the nation. In violation of the law which declares that the Sultan shall have no women in his harem except slaves, Osman chose three wives among the daughters of his first officers; and he conceived the fantastic plan of making a pilgrimage to Mecca: the Janizaries, being informed of this, rose in open rebellion, and put the question to the Mufti, if it was legal to kill those who give bad advice to the Sultan and urge him to innovations. The answer of the Mufti was affirmative. Osman, having refused to deliver up his counsellors, was deposed and put in prison, where he was strangled, the first example of a Sultan losing his life by the hands of his rebellious subjects. His counsellors were likewise put to death. His uncle, the deposed Mustafa, was delivered from his captivity and proclaimed Sultan.

Sultan Mustafa I., 2 (9th of Rejeb, A.H. 1031 till 4th of Zilkide, 1032; 20th of May 1622, till 30th of August, 1623). The incompetence of this prince had been seen in his first reign; during his second reign he showed all the symptoms of insanity. Dáud-Pasha, his favourite, was killed by the Janizaries; his successor, Husein-Pasha, was a blood-thirsty tyrant. He and the Sultan were both deposed by the Janizaries.

Sultan Mürad IV., or Amürad IV., the brother of Osman II., and the son of Ahmed I. (A.H. 1032 till 1049; A.D. 1623 till 1640). He was a child of twelve when he was raised to the throne, and for the first ten years he reigned under the guardianship of his mother, Mah-peiker (Moon-face). During the last seven years of his reign, he evinced the character of a cruel but active and enterprising tyrant. Shortly after his accession, Bekir, Pasha of Baghdád, rebelled, and a civil war resulted, in consequence of which Asia Minor was ravaged, and Baghdád fell into the hands of the Persians. Bekir lost his life in the beginning of these troubles, but the rebels found a new head in the person of Abáza-Pasha, who took arms against the Sultan on the pretext of avenging the murder of Sultan Osman II. Cherkess Mohammed, the grand-vizír, took the field against Abáza, but while the main force of the army was thus employed in Asia, a rebellion broke out among the Tartars of the Crimea, who in A.H. 1033 (A.D. 1624) defeated the troops of the Kapudan Pasha, who had been sent thither to quell the troubles. In the same year a hundred and fifty long barks, manned each with seventy Cossacks, appeared in sight of Constantinople, and ravaged the shores of the Bosporus. The terror in the capital was so great that the long iron chain with which the mouth of the port of Constantinople used to be closed was carried to the castles of the Bosporus, in order to close this channel and to prevent the Cossacks from penetrating into the sea of Marmara. In consequence of this event, and of the news that the grand-vizír had not succeeded in recovering Baghdád, the Janizaries revolted, and the uproar was only quelled after several ministers had been deposed or put to death. Khalíl-Pasha was appointed to supersede Cherkess Mohammed as grand-vizír, but no sooner had he appeared in the field than he was defeated by the rebel Abáza (A.H. 1036; A.D. 1626), and compelled to return to Constantinople. At last Khosrew-Pasha, the successor of Khalíl-Pasha, brought the rebel to obedience; but Abáza's power was so great, that he only submitted on condition that he should have full pardon (A.H. 1038; A.D. 1628). He was appointed pasha of Bosnia, because, 'as he did not know that country, there was no danger that he would rebel.' Khosrew-Pasha penetrated as far as Baghdád, and laid siege to the town, but the Persians surprised him, and forced him to retreat. He was afterwards beheaded. These unfortunate wars in Asia prevented Turkey from taking advantage of the critical position in which Austria was put by the Thirty Years' War. The Janizaries were so exasperated by all these defeats, that they threatened to depose the Sultan. They set fire to a quarter of Constantinople, and Mürad heard their cries, 'The only means to save the empire is thy sword!' This encouraged the young Sultan: he left the seraglio and presented himself to the troops, who received him with shouts of joy (A.H. 1042; A.D. 1633). Two years afterwards Mürad, at the head of a strong army, marched to the rescue of his Asiatic provinces. In his first campaign he took Erz-rúm, Eriwán, and Tabríz, and wherever he appeared he signalised his presence by cruelties; the people in the rebellious provinces were burnt, together with their villages and towns, and the least fault of his officers was punished with torture and death. He returned to Constantinople, and in A.H. 1047 (A.D. 1638) opened a fresh campaign for the deliverance of Baghdád. He took one of the great military roads across Asia Minor and Mesopotamia, and passed by the following towns: Scutari, Iznikmid or Nicomedia, Herzek, Iznik or Nicæa, Yeñi-Shehr, Eski-Shehr, Ak-Shehr (leaving Kutahia to his right), Koniah, Erekli, Adáná, Payas or Issus, Iskenderün or Alexandretta, Antioch, Haleb, Birejik or Birtha, Roha or Edessa, Diyarbekir, Mardin, Nisibin, Khabur, Kefr-zemán, near which he crossed the Tigris, Mosul, and from thence by two parallel roads, on the left bank of the Tigris, to Baghdád, where he arrived on the 197th day after having left Scutari. Baghdád was taken by storm on the 18th of Sha'bán, A.H. 1048 (25th of December, 1638). Out of 30,000 Persians, the garrison of the town, 10,000 had lost their lives during the siege, and 20,000 were massacred during and after the storm. According to some historians the number of the killed was 80,000, but this seems exaggerated, even if we comprehend under this number 30,000 Persian Shiites, inhabitants of Baghdád, who were slaughtered some days after the storm. A peace was concluded with Persia in A.H. 1049 (A.D. 1639), the Persians retained Eriwán, but Baghdád and its extensive territory was ceded to the Porte. (The details of this peace are contained in Hammer, cited below, vol. v., p. 266.) Mürad IV. died a short time after his triumphal entrance into Constantinople (A.H. 1049; A.D. 1640). Three of his brothers, and perhaps also his uncle, the deposed Sultan Mustafa I., were put to death by his order.

Sultan Ibráhím I., youngest brother of Mürad IV., and son of Ahmed I. (A.H. 1049 till 1058; A.D. 1640 till 1648). The conquest of Azof from the Cossacks, and a war with Venice, which resulted in the temporary conquest of a part of Candia, were the most remarkable events of the short reign of Ibráhím I. He spent his time in luxury and debauchery: his passion for women surpassed everything on record: the influence of these women, one of whom became a pasha, was unbounded. The decline of the power of the Osmanlis became conspicuous in the abuses, violent measures, and frequent rebellions which characterised this reign. Ibráhím perished in consequence of a revolt of the Janizaries, whose power was then as dangerous as that of the Prætorian soldiers under the Roman emperors; and his powerful grand-vizír, Ahmed-Pasha Hezarpárá, whose fiscal measures were insupportable, shared the fate of his master.

Sultan Móhammed IV., the son of Ibráhím I. (A.H. 1058 till 1099; A.D. 1648 till 1687), was a boy of seven years of age. The simple fact of the Janizaries having preferred a child to a man, proves the turbulent haughtiness of this body and the degenerate character of Ibráhím I. The beginning of the reign of Mohammed IV., who was under the guardianship of his grandmother, Mah-peiker, the widow of Ahmed I., was a series of troubles and calamities. An expedition against Candia failed, and in two battles off Chios and at the outer entrance of the Dardanelles the Venetians destroyed a considerable part of the Turkish navy. A revolt of the pages of the Sultan was a dangerous event; the troops in Candia mutinied; a body of the Janizaries ravaged the environs of Constantinople; and bands of robbers, commanded by Kárá-Haider-záde, became gradually an army of outlaws, who were not exterminated till after the greatest efforts of the pashas of Asia. The ministers were frequently changed (from 1648 to 1656 there were fifteen grand-vizírs): the grand-vizír Ipshir Mustafa Pasha was put to death; and in consequence of a revolution in the seraglio, the old Sultana Mah-peiker was strangled (A.H. 1061; A.D. 1651). The influence of the harem continued, and the disorders were augmented by serious religious differences. At last Mohammed Köprili became grand-vizír in A.H. 1066 (A.D. 1656), and under his and his successor's administration Turkey recovered from her depression.

Ragotzi, the vassal prince of Transylvania, having concluded a treaty with Austria, by which he ceded a considerable territory to this power, differences arose on that account between the Sultan and the emperor Leopold I., which led to a war in A.H. 1070 (A.D. 1660). Ahmed Köpríli, the son and successor of Mohammed Köprili, conducted this war with great energy, and the Turkish arms were signalised by the conquest of Neuhäusel, Leutra, Lewenz, and Novigrad. The auxiliaries of the Tartar khan penetrated into Moravia and Silesia. But in A.H. 1075 (A.D. 1664) the grand-vizír was routed at St. Gotthard by Montecuculi, the imperial fieldmarshal, who was assisted by a body of French auxiliaries commanded by marshal Coligny and the duke de la Feuillade. Some days after his defeat Ahmed Köprili concluded the peace of Vasvár, which was disadvantageous for Turkey inasmuch as the Turks were compelled to evacuate Transylvania, and to cede to the emperor the northern part of that quarter of Hungary which is situated between the Danube and the Theiss. This loss was compensated by the conquest of Candia by Ahmed Köprílí, in A.H. 1080 (A.D. 1669). In a war with Poland, the Turks were at first beaten at Choczim; but they afterwards took this important fortress, as well as the country between the Dniester and the Dnieper, and encamped under the walls of Lwów, or Lemberg (A.H. 1086; A.D. 1675). There they were routed by John Sobieski, king of Poland; but their power was still so great that, by the peace of Zurawna (A.H. 1087; A.D. 1676), they acquired Podolia and the famous fortress Kaminiec Podolski. A short war with Russia resulted in the conquest of Cehrin by the Turks (A.H. 1089; A.D. 1678). During this time the authority of the emperor Leopold I. was checked by the rebellion of Emmerich Tököli, who was chosen by his partisans king of Hungary, and who was supported by the Turks, then excited by their numerous victories. The consequence was a war with Austria, which broke out in A.H. 1093 (A.D. 1682), and in which Austria was supported by the princes of the empire and by the king of Poland. Kárá Mustafa Pasha, the grand-vizír, commanded the Turkish army as serasker, or general-field-marshal; and Sultan Mohammed IV., preceded by the standard of the prophet, left Constantinople and accompanied his army to Hungary (A.H. 1094; A.D. 1683). At Essek he received the homage of king Tököli. Few Austrian troops were in Hungary, and on the 19th of Rejib, 1094 (14th of July, 1683), Kárá Mustafa, with 200,000 men, encamped under the walls of Vienna. The heroic resistance of the citizens and the feeble garrison, commanded by Count Starhemberg, saved Vienna from the fate of Constantinople. On the 12th of September Kárá Mustafa was attacked by an army composed of the Austrian troops, commanded by the duke of Lorraine; of the troops of the empire, commanded by Maximilian-Emanuel, elector of Bavaria, who had under him twenty princes of the empire; and by a body of Polish auxiliaries, commanded by their gallant king, John Sobieski. The Turks were completely defeated: the victory was mainly due to the military talents of the king of Poland. Kárá Mustafa, abandoning his camp, fled to Hungary with the remnant of his army: 6000 men, 11,000 women, 14,000 girls, and 50,000 children had been carried off by the Turks into slavery. They were pursued by the imperial troops, who, in the course of three years, took the capital and the most important fortresses of Hungary, and routed the Turks at Parkany, at Hansabeg, and at Mohacs on the 25th of Rámázán, 1098 (4th of August, 1687). The Venetians acceded to the league against Turkey, and captured Santa Maura and several places in Epirus and Greece, and at last Morosini took Athens from the Turks, and forced them to evacuate Greece. So much disgrace after so many triumphs made the people despair. The Janizaries revolted, and Mohammed IV. exchanged his throne for a prison in the seraglio.

Sultan Soliman II. (III.), the brother of Mohammed IV., and son of Ibráhím I. (A.H. 1099 till 1102; A.D. 1687 till 1691), and Sultan Ahmed II., brother of Soliman II. (III.), and Mohammed IV., son of Ibráhím I. (A.H. 1102 till 1106; A.D. 1691 till 1695). The Austrians continued their victories; they took Belgrade, and routed the Turks at Slankamen, whereupon the fortress of Grand-Waradin surrendered to the emperor Leopold I. The Venetians conquered Chios. The internal state of the empire was deplorable; there was rebellion in all the provinces.

Sultan Mustafa II., the son of Sultan Mohammed IV. (A.H. 1106 till 1115; A.D. 1695 till 1703). The Turks gained some advantages over the Venetians by recovering Chios, and beating their fleet off Chios in A.D. 1695; and the Tartars ravaged Poland as far as Lwów. But in Hungary the Imperialists were still victorious, and a strong body of them crossed the Danube and penetrated as far as the foot of the Balkan. At the same time Peter the Great, eager to have a free communication with the Black Sea, concluded an alliance with Austria against Turkey, and laid siege to Azof. This key of the Don fell into his hands in A.H. 1108 (A.D. 1696). In the following year the Venetian fleet was defeated by the Turks at Mitylene, but Prince Eugene defeated the grand-vizír in the battle of Zenta. These events, and the impossibility of the Porte carrying on the war any longer without ruining the people by taxes, led to the peace of Carlowicz, which was concluded in A.H. 1111 (A.D. 1699). Venice was confirmed in the possession of the Morea as far as the isthmus of Corinth, and of Dalmatia; Russia made only a truce for two years; Poland received Podolia, the Porte renouncing this conquest, and the fortress of Kaminiec Podolski; Austria received all Hungary, except the banat of Temesvár, and the protectorship of Transylvania, which country, as well as Hungary, ceased to be vassal states of Turkey. This peace was concluded under the mediation of England and the United Provinces of the Netherlands. Since Timur had made sultan Bayazid I. his prisoner, this was the first time that Turkey had been humbled. However, her long struggle with Austria, Venice, Poland, and Russia was not inglorious, and did honour to the energetic, though often despotic, administration of Husein Köprili, who directed affairs for several years, first as vizír, and afterwards as grand-vizír. The Osmanlis felt the decline of their power with deep regret; but they saw the causes of it in the system of administration. An insurrection was prepared, a well-organized army of rebels marched to Constantinople, and sultan Mustafa was deposed in A.H. 1115 (A.D. 1703).

Sultan Ahmed III., brother of Mustapha II., and son of Mohammed IV. (A.H. 1115 till 1143; A.D. 1703 till 1730). He was at first unable to quell those disorders which were the cause of his accession, and in fifteen years he had fourteen grand-vizírs. One of them, 'Ali Chorlíli, a man of remarkable talents, endeavoured to derive advantage from the war between Peter the Great and the king of Sweden, Charles XII., and it is now known that he offered Charles the assistance of the Porte if he would carry the war into the south of Russia. Charles accordingly penetrated into the Ukraine, but his defeat at Pultawa destroyed his plans, and he took refuge in Turkey. [CHARLES XII.] Sultan Ahmed tried in vain to get rid of the king, for he was a lover of peace, and preferred music, poetry, and pleasure to the chances of war. He deposed 'Ali Chorlíli, who could not succeed in removing the king of Sweden; but the new grand-vizír, Baltájí Mohammed, was not more successful than 'Ali, and the intrigues of Charles at last prevailed in the diwan, and war was declared against Russia. But for the treason of Baltájí Mohammed, Peter the Great would have been obliged to surrender to the Turks with his whole army. The empress Catharine, who was with him in the camp, saved him by bribing the grand-vizír. The peace of the Pruth was concluded in A.H. 1123 (A.D. 1711), and the Czar was allowed to retire to his empire after having ceded the fortress of Azof. Charles XII. left Turkey in A.D. 1713. The timid policy of the Porte towards Russia was in many respects produced by the desire of profiting from the weakness of Venice, an enemy then of less power than the rising state of Russia. A pretext for war was easily found, and Venice was attacked in A.H. 1126 (A.D. 1714). Sultan Ahmed led his army into Greece, and the grand-vizír, Damah 'Ali Pasha, conquered the Morea in one campaign. Upon this the emperor Charles VI. concluded an alliance with Venice, under the pretext of maintaining the political balance fixed by the peace of Carlowicz, and thus Turkey was involved in that memorable war, the result of which was to lessen her influence in Europe. Defeated by Prince Eugene at Peterwaradin in A.H. 1128 (A.D. 1716), and at Belgrade in A.H. 1129 (A.D. 1717), the Turks were disbanded; and as early as A.H. 1130 (A.D. 1718) the Sultan concluded the peace of Passarowicz, by which he ceded to Austria the banat of Temesvár, and the western part of Wallachia and Servia, with Belgrade; he also restored his Venetian conquests, except the Morea, which was ceded to Turkey. Turkey recovered from this blow by the wise administration of Ibráhím Pasha, who was appointed grand-vizír in A.H. 1130 (A.D. 1718), and who held the office till A.H. 1143 (A.D. 1730). Ibráhím, far from attacking Peter the Great, who was ready to invade Persia, then governed by Shah Tahmásp, concluded an alliance with Russia; and in the ensuing war with Persia, which was terminated in A.H. 1138 (A.D. 1726), the victorious Turks acquired a considerable part of north-western Persia, which was afterwards ceded to the Sultan. In A.H. 1143 (A.D. 1730) Tahmásp suddenly recommenced hostilities, and recovered the provinces which he had ceded to Turkey. When the news of this invasion reached Constantinople, the Janizaries accused the grand-vizír of negligence, and revolted, in consequence of which Ibráhím lost his life and the Sultan was deposed. During the reign of Sultan Ahmed III., European arts and sciences found their way to Constantinople, where the first printing-office was established, under the patronage of the grand-vizír Ibráhím, by Ibráhím Basmájí, a Hungarian renegade, who in the course of twelve years published sixteen works, chiefly historical.

Sultan Mahmud I., the son of Mustafa II. (A.H. 1143 till 1168; A.D. 1730 till 1754). The Turkish seraskier, 'Ali Hekim-zade, defeated the Persians at Hamadán, and conquered Tabríz; but notwithstanding these triumphs the timid diwan concluded a peace with Tahmásp, which, although it was not without advantages for Turkey, was far from satisfying the nation (A.H. 1144; A.D. 1732). A revolt ensued, and the brave 'Ali Hekim-zade was appointed grand-vizír. Shortly after this, Nadir-Khuli-Khan usurped the throne of Persia, and renewed the war with the Turks, who, at first victorious under Topal Osman, were entirely defeated under 'Abdú-llah Köprili, and compelled to beg for peace and to renounce the provinces which had been ceded to them during the reign of Ahmed III. (A.H. 1149; A.D. 1736). Previously to this peace differences had arisen between the Porte and Russia. Feth-Ghiray, the khan of the Crimea, had received orders from Constantinople to march across the steppe of the Kuban, to cross the Caucasus, and to attack the Persians in Georgia. The nations of the Caucasus, especially the Cherkesses, were neither subject to nor vassals of the Porte, but for centuries they had been in friendly intercourse with Constantinople; they regarded the sultans as the natural protectors of their liberty and their religion; and they were so far from opposing themselves to the march of the Tartar khan, that, on the contrary, their chiefs saluted him as the representative of the Sultan, and proposed to assist him against the Persians. The jealousy of Russia was roused, and the cabinet of St. Petersburg suddenly pretended that the sovereignty of the Little and the Great Kabarda, the chief provinces of the Cherkesses, belonged to the Czars. The Russian commander in Daghistán, the Prince of Hesse Homburg, declared to the khan that he considered his march through the Kabarda as a violation of the Russian territory; and as the khan continued his march in spite of his menaces, he attacked the Tartars as soon as they had crossed the range of the Caucasus, and approached the river Samur, near the frontiers of Daghistán. Feth-Ghiray defended himself until orders came from Constantinople to return to the Crimea. The question if Russia had any right of sovereignty over the Kabarda was the first cause of a war which was begun by the Russians before any declaration of war had been made (A.H. 1149; A.D. 1736). Austria concluded an offensive and defensive alliance with Russia, and declared war against the Porte in the following year (A.H. 1150; A.D. 1737).

The war with Austria was glorious for Turkey. The Austrians, commanded by Count Wallis and the Prince of Hildburghausen, both incompetent generals and imprudent statesmen, were defeated in several pitched battles, and sustained severe losses in frequent skirmishes, especially against the former grand-vizír, 'Ali Hekim-zade, who was then pasha of Bosnia. The emperor concluded peace with the Porte at Belgrade (A.H. 1152; A.D. 1739), and ceded to her the conquests of Prince Eugene, that is, the western part of Wallachia, and Servia, with Belgrade.

The Russian war was disadvantageous for Turkey. Count Münnich, the Russian field-marshal, overran part of the khanat of the Crimea; he took Choczim by storm; and he conquered Moldavia. By the peace of Nissa, which was concluded some days after the peace of Belgrade, Russia acquired the privilege of building a fortress on the Kuban; but both the Kabardas were declared independent.

The latter years of the reign of Mahmud I. were troubled by a short war with Persia; by troubles in Egypt and at Baghdád, and by the disturbances produced in Arabia by the Wahabites, a sect of Mohammedans, whose chief, 'Abdú-l-Wahháb, became first known towards A.H. 1162 (A.D. 1749). France, supported by the ambassador Villeneuve, and by Count Bonneval, who had entered the service of the Sultan, had more influence at Constantinople during this period than any other European power. Mahmud I. died a natural death in A.H. 1168 (A.D. 1754).

Sultan Osman III., the brother of Mahmud I., and the son of Mustafa II. (A.H. 1168 till 1171; A.D. 1754 till 1757); and Sultan Mustafa III., the son of Ahmed III. (A.H. 1171 till 1187; A.D. 1757 till 1773). The short reign of Osman III. is not remarkable for any events of importance, except some diplomatic transactions with Prussia. Sultan Mustafa, contrary to the habit of the sultans of that period, administered the state. He resisted all temptations to interfere in the Seven Years' War, either by assisting or attacking Austria. But the increasing power of Russia induced him to declare war against the empress Catherine II., before his army and his finances were in a state to undertake a struggle with that formidable enemy. The direct cause of this war, or at least the direct pretext, was the Sultan's design to save Poland from ruin through Russian interference in her civil troubles. However, it is but just to remark that, in spite of this pretext, the first idea of dismembering Poland was conceived at Constantinople. This plan was formed by Sultan Mustafa III. himself, at whose order the Reis Efendi Isma'íl Ráif proposed to the Austrian ambassador, Baron Thugut, in a secret conference by night, to divide Poland between the Sultan and the emperor Joseph II. This proposition was rejected by Austria. (Extract from the Austrian ambassador's (at Constantinople, Baron Thugut) *Secret Correspondence with the Ministry at Vienna*, in Hammer, vol. viii., p. 373.) This conference took place ten months before Prince Henry of Prussia, who is generally believed to be the first author of that project, mentioned such division to the empress Catherine II. of Russia.

War was declared in A.H. 1182 (A.D. 1768): it was glorious for Russia and most disastrous for Turkey. The Russian field-marshal Rumanzow took Bender, Isma'íl, Kilia Ibráíl, and other fortresses between the Danube and the Dnieper, and the whole country between these two rivers fell into the hands of the Russians. They attacked the Crimea on two sides: they took the famous lines of Perekop by storm, and overran the peninsula from the north, while another body, after having conquered the island of Taman, crossed the Cimmerian Bosporus, and took Kertsh, Yenikale, and Kaffa in the East (A.H. 1185; A.D. 1771). The khan Maksud-Ghiray abandoned his capital, Bakje-seraï, and fled to Constantinople, and the Russians had Shahín-Ghiray elected in his place. As early as the beginning of the war, a Russian fleet, commanded by Spiritow, Alexis Orlow, and Elphinstone, left Kronstadt for the Mediterranean. The diwan was informed of it in time, but declared such an expedition to be impossible, there being no communication between the Baltic and the Mediterranean; and when at last they could no longer doubt about the fleet being under sail, they requested the Austrian ambassador not to allow the passage of it by Trieste and the Adriatic. No sooner were the Russians in the Mediterranean than an insurrection, kindled by Russian agents, broke out in Greece and in the Herzogevina, and the Russian commanders proclaimed the independence of the Greeks. The Russians made few conquests in Greece, but in A.H. 1184 (A.D. 1770) they destroyed the Turkish fleet in the bay of Chesme, after the battle of Lepanto, the greatest disaster which had befallen the navy of Turkey. The embarrassment of the Porte was so great that in A.H. 1184 (A.D. 1770) she concluded a treaty with Austria, promising her the former Austrian part of Wallachia, a subsidy of 11,250,000 gulden, and several other advantages, on condition of Austria endeavouring to obtain for Turkey an honourable peace with Russia. The effect of this treaty was a truce between the Russian and the Turkish armies, and the congresses at Fokshán and at Bukarest; but the negotiations proved abortive, and the hostilities recommenced in A.H. 1186 (A.D. 1773). The Turks were again beaten at Rusjuk and Kaïnarjí, and although the serasker Osman-Pasha obtained considerable advantages over them at Silistra, Rumanzow defeated him in his turn at Kárásu in Bulgaria. Shortly afterwards Sultan Mustafa III. died on the 9th of Shewwal, 1187 (24th of December, 1773).

Sultan 'Abdú-l-Hamid I., or Ahmed IV., as he is called by some European historians, the son of Ahmed III. (A.H. 1187 till 1203; A.D. 1773 till 1789). Field-marshal Rumanzow continued his victories: his generals, Kamenski and Suwarow, defeated the Turks at Basarjik and Koslije, and in the month of July Kamenski entered the passes of the Balkan and besieged the grand-vizír Musa Oghli. The Porte now yielded to the propositions of Russia, and peace was concluded in the same month (A.H. 1188; A.D. 1774) at Kuchuk- Kaïnarjí. By this peace Russia obtained the Great and the Little Kabarda, that is, the Porte engaged not to oppose the Russian occupation of these countries, which were declared independent by the peace of Nissa; Russia also obtained the fortresses of Azof, Kilburn, Kertsh, and Yenikale; the country between the Bog and the Dnieper; the free navigation of the Black Sea, and a free passage through the Bosporus and the Dardanelles; the co-protectorship over Moldavia and Wallachia; and the protectorship over all the Greek churches within the Turkish empire. The khanat of the Crimea was declared independent, but it soon became a prey to Russia. Three years afterwards the Porte was obliged to cede the Bukowina to Austria.

By the peace of Kuchuk-Kaïnarjí Turkey was brought to a political dependence on Russia, and, notwithstanding many bloody wars, the Porte has not yet succeeded in shaking off the yoke.

Sultan 'Abdú-l-Hamid, a weak and indolent man, was however disposed to recommence war with the empress Catherine II. His finances were exhausted, and to fill the treasury the subjects of the Sultan were forced to sell their gold and silver plate or ingots to the treasury at a rate far below the real value of the metal. The necessity of a war became urgent after Catherine had annihilated the independence of the Crimea and united this state with her empire. Immense preparations were made throughout the Turkish empire, and Catherine in her turn concluded an alliance with Austria. The Porte declared war in A.H.

1201 (A.D. 1787), long before her preparations were finished. Her armies obtained some advantages against the Austrians, commanded by an emperor, Joseph II., who was a philosopher and legislator, but not a general. The Russians defeated the Turks, who sustained great losses of men and of territory. Potemkin, the Russian field-marshal, took Oczakow by storm (A.H. 1202; A.D. 1788), and the garrison and the inhabitants were massacred. Sultan 'Abdú-l-Hamid died soon after this unfortunate event.

Sultan Selím III., the son of Mustapha III., and the nephew of 'Abdú-l-Hamid (A.H. 1203 till 1222; A.D. 1789 till 1807). This sultan was one of the most enlightened men of his nation and of the East. Before his accession, while confined to the seraglio, he studied Turkish and European history, and conceived the plan of becoming the regenerator of Turkey. He had a regular correspondence with distinguished Turkish statesmen, with Count de Choiseul, the French ambassador, and it is said that he exchanged letters with the king himself, Louis XVI. of France.

He resolved to put himself at the head of his armies, but he was dissuaded from it by the diwan, who were afraid of troubles in Constantinople. The war meanwhile was carried on with great loss. The Turks were beaten at Martinestie by the united Austrians and Russians; the Austrians took Belgrade; the Russians, Bender and Isma'íl; and Turkey would have been overrun, but for the intervention of England, Prussia, and Sweden. Thus peace was concluded in A.H. 1205 (A.D. 1791) at Szistowa with the emperor Leopold II., the successor of Joseph II., who restored his conquests to Turkey; and with Russia in A.H. 1206 (A.D. 1792) at Jassy. By the peace of Jassy the Porte consented to the incorporation of the Crimea with Russia, and the Dniester became the frontier between the two empires. Sultan Selím now began his work of reformation, but during a long period his efforts were checked by troubles in Syria and Egypt: by the rebellion of Paswán Oghlu, Pasha of Widdin; and by the increasing power of 'Ali Pasha of Janina. [ALI PASHA.] The conquest of Egypt by Bonaparte led to a war with France. The grand-vizír, Yúsuf Pasha, was routed in the battle of Abukír, and his army was completely destroyed by the French, but Egypt was taken by the English, who restored it to the Porte in A.H. 1218 (A.D. 1803). Previously to this, Selím had concluded an alliance with Russia, Naples, and England, in consequence of which a united Turkish and Russian fleet took possession of the Ionian Islands, which, conformably to a treaty concluded between Selím and the emperor Paul, were constituted into a republic, A.H. 1215 (A.D. 1800). Selím acquired the protectorship of this new republic on condition of consenting to the incorporation of the kingdom of Georgia with Russia. Peace with France was concluded in A.H. 1217 (A.D. 1802), no change taking place, except that France acquired the free navigation on the Black Sea, a privilege which was soon afterwards granted to England and to several other European powers. Having thus secured his political position, Selím at last began his reforms. His administrative division of the empire has been mentioned above. In order to regenerate his army, the discipline of which was entirely slackened, he appointed a commission, from which the troops received a new organization, the 'Nizam Jedid,' by which they were put on a footing similar to that of European armies. He also introduced several changes into the system of taxation: he gave a new organization to the diwan; but in order to fill the treasury he debased the money. These reforms were the pretext for many rebellions. In the meantime the jealousy of England and Russia was excited by the increasing influence of the French ambassador, Count Sebastiani; and Selím, as well as the emperor Alexander, having both violated the treaty of Kuchuk Kaïnarjí by arbitrarily interfering in the domestic affairs of Moldavia and Wallachia, a war broke out between Turkey and Russia, assisted by England (December, 1806). Admiral Duckworth forced the passage of the Dardanelles, and threatened to bombard Constantinople. Sultan Selím displayed the greatest activity in preparing for resistance, and Admiral Duckworth, fearing that his retreat would be cut off, sailed back to the Mediterranean. Constantinople was saved, but the Russians made continual progress on the Danube. The defeats of the army were considered by the people as a consequence of the 'Nizam Jedid;' they manifested their dissatisfaction, and the Janizaries, who saw their ruin in the new organization, broke out in rebellion. To the number of 15,000 men, they occupied Pera and directed their ordnance against the Seraglio. The Mufti joined their party, and by a fetwá declared 'that Sultan Selím III. had forfeited the throne because he had procreated no heir, and introduced the Nizam Jedid and several other innovations.' Thus Selím III. was deposed, and confined to the Seraglio.

Sultan Mustafa IV., the son of 'Abdú-l-Hamid (A.H. 1222 till 1223; A.D. 1807 till 1808). Immediately after his accession Mustafa abolished the reforms of his predecessor. The Turkish fleet was entirely defeated by the Russians off Lemnos, and terror spread over Constantinople. Mustafa Baïraktar, pasha of Rusjuk, the friend of the deposed Selím, appeared suddenly with an army before the capital, and demanded the deposition of Mustafa. The murder of Selím, by order of Mustafa IV., was the first consequence of this bold step; but the pasha Rusjuk entered Constantinople, and Mustafa was deposed

Sultan Mahmud II., the son of 'Abdú-l-Hamid I., and the brother of Mustafa IV. (A.H. 1223 till 1256; A.D. 1808 till 1840). Before his accession he was instructed for some time by the deposed Sultan Selím III., who taught him the principles of reform necessary for Turkey. He was indebted for his accession to Mustafa Baïraktar, who, after having been appointed grand-vizír, re-established the Nizam Jedid. The Janizaries again revolted, and they stormed the seraglio and the barracks of the new troops (Seymen). To save the empire, Mustafa Baïraktar put to death the deposed Sultan, Mustafa IV., and then blew himself up, together with crowds of the Janizaries. Mahmud owed his life to the circumstance of his being the only adult descendant of Osman; and to secure himself on his throne, he put to death the infant son of Mustafa IV., and ordered four pregnant slaves of the deposed Sultan to be drowned in the Bosporus. Compelled to yield to the claims of the Janizaries, he abolished the Nizam Jedid. Notwithstanding this the troubles continued, and the Janissaries became masters of the empire. The energetic character of Mahmud became conspicuous in the administration of foreign affairs. He concluded peace with England in A.D. 1809, and continued the war against Russia with great vigour. The Russian had penetrated as far as the passes of the Balkan, but they were forced to retire beyond the Danube: and when they had crossed this river a second time, they were again compelled to hasten back to Wallachia. Internal troubles divided the forces of the Sultan. The Servians, commanded by Czerny George, and supported by Russia, shook off the Turkish yoke: the pashas of Widdin, of Damascus, of St. Jean d'Acre, of Trebizond, of Haleb, of Baghdád, of Latakia, and several others, were in revolt; 'Ali, pasha of Janina, was independent in Epirus, and aimed at the possession of Greece; and Mehmed 'Ali in Egypt laid the foundation of a power that was to bring Mahmud II. to the brink of ruin. Under these circumstances the Sultan concluded with Russia the peace of Bukarest (A.H. 1227; A.D. 1812), by which the Porte ceded the country east of the Pruth, Bessarabia, with the principal mouth of the Danube, and part of the eyalet of Childir in the Caucasus. During the ensuing years the Sultan, principally assisted by his favourites, Berber Bashi and Khalet Efendi, effected those radical reforms of which we have spoken in the beginning of this article, and for which he justly deserves the title of 'the Reformer of Turkey.' The destruction of the power of 'Ali, pasha of Janina, was a great triumph, but the insurrection of the Greeks and their final deliverance was a fatal blow to Turkey. Several European powers took the Greeks under their protection. The Turkish navy was destroyed in the battle of Navarino, October 20, 1827, by the combined fleets of England, France, and Russia; and Turkey was weakened by the cession of the largest part of Greece, from which she had hitherto taken her best sailors. This part of Greece was erected into an independent kingdom, and a Bavarian prince, Otho, was placed on the throne. The despotism of the Janizaries compelled Mahmud either to abandon the government to the turbulent mob, or to exterminate them. To quell a revolt in A.H. 1238 (A.D. 1822), he sacrificed the Mufti, his best officers, Khalet Efendi, Berber Bashi, and his favourite wife. He subsequently succeeded in destroying the Janizaries, and with the downfall of this military body, which was once the bulwark of the empire, begins a new æra in the history of Turkey. Serious differences with Russia on account of Moldavia and Wallachia were settled by the treaty of Ak-kermán in A.H. 1242 (A.D. 1826); but Mahmud, having shortly afterwards succeeded in finishing the reform of his army, declined any European intervention in the affairs of Greece, which was then still in insurrection. Thus war broke out with Russia in A.H. 1244 (A.D. 1828). In the first campaign the Russians made little progress either in Europe or in Asia; but in the second campaign, field-marshal Diebitsch defeated the main army of the Turks at Shumla, in the Balkan, took Adrianople, and had his light horse swarming in the environs of Constantinople. In the same time Field-marshal Paskiewicz conquered Erz-rúm in Asia. Threatened by a revolt in Constantinople, and persuaded by the European powers, especially by England, Mahmud concluded peace with Russia at Adrianople, A.H. 1245 (A.D. 1829), by which Russia acquired parts of the eyalets of Childir and Kars towards the Caucasus, and the important fortress of Anapa near the mouth of the Kuban. The Sultan recognised the independence of Greece. Moldavia and Wallachia acquired an independent administration, guaranteed by Russia, which power has now much more influence in these two principalities than Turkey: Servia was recognised as a vassal state of the Porte. The Sultan had to pay ten millions of ducats, and the Russians acquired the right of occupying Moldavia, Wallachia, and the town of Silistra, until the payment of this sum; but the emperor recalled his troops from these countries after having received five millions, and remitted the Sultan the rest. No sooner was this peace concluded than troubles arose in Bosnia, Albania, Macedonia, Asia Minor, and Syria; but the differences with Mehmed 'Ali, pasha of Egypt, were still more dangerous. [EGYPT.] The pride of Sultan Mahmud was humbled by his pasha having founded a power which had only the name of a vassal state, and which was then of greater importance than that of Turkey, broken by the war with Russia. The Sultan attacked his vassal in A.H. 1247 (A.D. 1831) in Syria, but his armies were defeated; and in the following year Ibráhím-Pasha, the son of Mehmed 'Ali, advanced as far as Kutayah, about 130 miles distant from Constantinople. Peace was concluded in A.H. 1249 (A.D. 1833), at Koniah, by which Mehmed 'Ali, who had held the eyalet of Candia since the war against the Greeks, acquired all Syria, and Ibráhím-Pasha was invested with Adáná as Mutesellim. In this war Constantinople was saved by the intervention of the emperor Nicholas of Russia, and a Russian army was transported by sea to Asia Minor to stop the progress of the victorious Ibráhím. A consequence of this assistance was the treaty of Hunkiar Skelessi (A.H. 1249; A.D. 1833) between Russia and Turkey, by which the Porte engaged herself not to allow the passage of the Dardanelles to any enemy of Russia. In A.H. 1251 (A.D. 1835) a Turkish fleet took possession of Tripoli (Africa), which is now entirely dependent on Turkey. During these troubles and wars the Sultan continued his reforms, and ameliorated the administration of the provinces by depriving the pashas of their civil authority, and appointing separate civil governors. He also ordered roads to be constructed, and established a regular post service. Sultan Mahmud II. was interrupted in his peaceful occupations by a new war with Mehmed 'Ali; but he died before he had heard of the total defeat of his armies by Ibráhím-Pasha in A.H. 1256 (A.D. 1840).

Sultan 'Abdú-l-Mejid I., the son of Mahmud II., the present Sultan. He was delivered from his dangerous enemy by the intervention of England, Russia, and Austria. Admiral Napier took Beyrút and St. Jean d'Acre (A.H. 1256; A.D. 1840), and in one campaign Ibráhím-Pasha was compelled to evacuate Syria, which was restored to the authority of the Sultan. Mehmed 'Ali however was recognised as pasha of Egypt with her dependencies, and now pays an annual tribute to the Sultan.

(Hammer, *Geschichte des Osmanischen Reiches* (the tenth volume of this work contains a list of 3000 works concerning Turkey); Hammer, *Des Osmanischen Reiches Staatsverfassung und Staats Verwaltung;* Knolles, *The Turkish History*, 6th edit., containing the *State of the Ottoman Empire*, by Sir Paul Rycaut; *A General History of the Ottoman Empire*, 1740, gives good information about the African provinces and dependencies of Turkey; Thornton, *The Turkish Empire;* Slade, *Travels in Turkey;* Urquhart, *Turkey and its Resources;* Napier, *The War in Syria;* Marsigli, *Stato Militare dell' Imperio Ottomanno;* D'Ohsson, *Tableau Général de l'Empire Ottoman;* Tott, *Mémoires sur les Turcs et les Tartars.* The best map of Turkey is that of Lieutenant-Colonel Weiss, in twenty-one sheets. As to the Turkish sources, comp. TURKISH LANGUAGE AND LITERATURE.)

TURKISH CHRONOLOGY. The Turks, like all the other Mohammedans, have adopted the æra of the Hijra, which begins with the 16th of July, A.D. 622. [ÆRA.] The year of the Hijra contains 12 months of alternately 30 and 29 days, or, more exactly, 354 days, 8 hours, and 48 minutes; and 32 of our (solar) years are equal to 33 Mahommedan (lunar) years, 6 days, 8 hours, and 16 minutes. On these facts is founded the following easy rule for finding the Christian year which corresponds to any given Mohammedan year:—

The number of centuries contained in the given Mohammedan year is multiplied by 3; to the product are added as many units as the period of 33 years is contained in the number of those years which are in the given Mohammedan year besides the centuries; the sum thus obtained is deducted from the given year; and to the rest is added 621, or the number of full Christian years before the beginning of the Hijra: the sum thus obtained corresponds to the Christian year.

Example: What year of Christ corresponds to the Mohammedan year 1188 (peace of Kuchuk Kaïnarjí)?

11 (the number of centuries) × 3 . . = 33
2 (the units of the period of 33 years contained in 88) + 33 . . . . . . = 35
1188 (the given year) − 35 . . . = 1153
621 (the number of years before the Hijra) + 1153 = 1774

This is correct, the peace of Kuchuk Kaïnarjí having been signed in A.D. 1774.

To change a Christian year into a Mohammedan year requires only an inversion of the preceding rule.

Example: What Mohammedan year corresponds to the Christian year 1774?

1774 − 621 . . . . . . = 1153
11 (the number of centuries in 1153) × 3 . = 33
1 (the number of times which 53 contains 33) + 33 . . . . = 34
34 + 1153. . . . . = 1187

We have seen above that the Mohammedan year corresponding to the Christian year 1774 was 1188; but the result is correct notwithstanding the different results in the two cases; for the beginning of A.D. 1774 falls in the latter part of A.H. 1187, and the beginning of A.H. 1188 and the greater part of this year falls in A.D. 1774. Thus the latter rule is only the complement of the first, and by employing both the reader will always know whether a given Mohammedan year falls entirely in one Christian year, or whether it falls in part of one and in part of another Christian year; and he will know the same for a Christian year with regard to a Mohammedan year. If this is true, the consequence will be that, if a Mohammedan year falls entirely in the course of one Christian year, there will be no difference in the result obtained by employing successively both the rules. This is in fact the case, as may be seen by the following example:

The year A.H. 522 begins on the 5th of January, A.D. 1128, and ends on the 24th of December of the same year 1128.

Rule 1—for A.H. 522: 5 × 3 . = 15
522 − 15 . . . = 507
507 + 621 . . . = 1128

Rule 2—for A.D. 1128: 1128 − 621 = 507
5 (centuries) × 3 . . = 15
15 + 507 . . . = 522

from which we may conclude that the year 522 A.H. falls entirely in the course of the year 1128 A.D. To make this more intelligible, we observe that the Mohammedan year being composed of lunar or moveable months, its beginning is likewise moveable, and in the course of 33 years it goes successively through all the twelve months of our year. The above-mentioned two rules will be good till A.H. 1401 (A.D. 1980). The determining of the corresponding days of the two æras presents considerable difficulties, and cannot conveniently be given here.

TURKISH LANGUAGES AND LITERATURE. The Turkish languages form a particular family, which differ from the Arabic, the Persian, the Mongol, and the Chinese. The principal Turkish languages are the following:—

1. Uighur. This language is considered the most antient of

all the Turkish dialects, and is still spoken in eastern Turkistán, especially in the country between Káshghar and Kámul. The Uighur was originally written with fourteen, and afterwards with sixteen letters, which, according to Abel Rémusat, are an imitation of the Syriac alphabet, although there is some reason to believe that they have been invented by the Uighurs themselves. They were afterwards adopted by the Mongols, who however have modified them. The Uighur language was cultivated at a very early period, and, as it seems, has had considerable influence on the Chinese literature. The number of foreign words introduced into the Uighur is not very considerable, and this language is consequently the purest of all the Turkish dialects. The Bodleian Library contains a beautiful Uighur manuscript, the 'Bakhliyár-Námeh,' written in A.H. 838 (A.D. 1434). Two other Uighur manuscripts on Mohammedan divinity are in the Royal Library at Paris, and a fourth, the 'Káudat-ku-bilik,' or 'The Science of Government,' has been sent to Paris by baron Hammer. This work was computed about A.H. 460 (A.D. 1069), during the reign of Alp-Arslán, sultan of the Seljuks; but the copy of baron Hammer dates only from A.H. 843 (A.D. 1459). The Uighur language is very little known in Europe.

2. Jagatáï, in the greater part of independent Turkistán. This language, which was originally written with the Uighur characters, and which, in antient times, greatly resembled the Uighur language, is remarkable for its strength, perspicuity, and simplicity. Turkistán, especially Samarkand and Bokhara, having been the centre of the power of the successors of Genghis-khan and Timur, the Jagatáï was cultivated at an early period, and many Arabic and Persian words were introduced into it. The Arabic characters were substituted for the Uighur letters, but not till a considerable time after the Mohammedan religion had been introduced into Turkistán. The Jagatáï language has a valuable literature. The 'Wáki'áti Báburí' is an autobiography of Sultan Báber, the conqueror of Hindustán (A.H. 900 till 938; A.D. 1494 till 1531). It has been translated into English under the title 'Memoirs of Zehir-ed-dín Muhammed Baber, Emperor of Hindustan, written by himself;' translated partly by the late John Leyden, M.D., and partly by W. Erskine, Esq., 4to., London, 1826. It has also been translated into Persian. The Jagatáï MS. of this work is in the library of the India House, London. The famous 'Genealogical History of the Turks,' by 'Abú-l-gházi (Bahádür Khan, Sultan of Khowaresm), was originally written in the Jagatáï language. The first MS. of this work known to Europeans was discovered by Swedish officers, who, after the battle of Pultawa, were sent as prisoners to Siberia. One of them translated it into French, from which language it was re-translated into English, under the title 'The Genealogical History of the Tatars,' which forms the first volume of 'A General History of the Turks, Moguls, and Tatars,' 2 vols. 8vo., London, 1730. The text of 'Abú-l-gházi has been edited by Frähn. (Kazan, 1825.)

3. Kiptshak dialects, in the eastern part of European Russia and Western Siberia. [TATARS, *Kiptshak.*] The purest among these dialects is that of Kazan, in which several books have lately been printed. Some of these are much mixed with Finnish words.

4. Kirghiz, the language of the Kárá Kirghız, and the Kirghiz Kaïsák, who live a nomadic life between the Ural and the Chinese frontier.

5. Caucaso-Danubian, in several subordinate dialects spoken by the Noghaïs, the Kazi-Kumüks, and other Turkish tribes in southern Russia.

6. Turkomán.

7. Austro-Siberian dialects. They are very numerous, and more or less mixed with Mongol or Samoyede words. They are spoken by the Turkish tribes that live in the middle, eastern, and southern parts of Siberia.

8. Chuwash, spoken by the Chuwashes, who live between the Sura and the Wolga, and in some adjacent countries of eastern Russia. The Chuwash differs considerably from the Kiptshak dialects in the neighbouring countries, and it contains a great number of Finnish words. (Schott, *De Lingua Tschuwaschorum Dissertatio.*)

9. Osmanli, or Turkish, commonly called so. This dialect, which is spoken by the Turkish conquerors of the Byzantine empire, must be considered as a compound of the antient Seljukian language and that of the tribe of the Káyi, from which the Osmanlis are descended. It is the richest and most polished of all the Turkish dialects; and its regularity, precision, and elegance are such, that Jaubert says, if any academy were commissioned to make a language, it would not form one more perfect than the Turkish. Another principal feature of this language is its dignity, with regard to which Sir William Jones says, 'The Turkish language has an admirable dignity. The Persian is fit for joyous and amatory subjects, the Arabic for poetry and eloquence, but the Turkish for moral subjects.' Turkish is now the diplomatic and official language not only of Turkey, but Egypt, Tunis, and Tripoli, and formerly of Algiers. The Osmanlis having received their civilization from the Arabs and the Persians, and the Korán (which among the Mohammedans is never translated from the Arabic into any other language) being still the source of theology and legislation, a great many Persian and Arabic words have gradually found their way into the Turkish language. However the groundwork is Turkish, and the Turks pronounce the Arabic words in a much softer way than the Arabs, a difference which is principally remarkable in the pronunciation of the gutturals and the long vowels.

The Turkish alphabet is composed of thirty-three letters, twenty-eight of which are taken from the Arabic alphabet; four (*pä*, *chim*, *yä*, and *ghief*) from the Persian; and one, the 'Saghir nún' (*ñ*) is exclusively Turkish. These letters are written from right to left. Turkish is also, and very frequently, written with Armenian characters, especially by the merchants. There is no article, but the demonstrative pronoun 'bu' ('that' or 'this'), and the cardinal number 'bir' ('one') sometimes take its place. There is no gender. The declension of the nouns is easy: the plural is formed by annexing 'ler' or 'lar' to the word, and there are six cases as in Latin. The adjectives have neither declension nor gender. The declension of the pronouns is analogous to that of the nouns, but not always exactly the same. There are eight kinds of verbs, viz. auxiliary, active, passive, negative, impotential, causative, reciprocal, and personal. The infinitive of all regular verbs is formed by means of the syllables 'mek' or 'mak;' they become passive by taking the syllable 'il' before 'mek' or 'mak.' The verbs have six moods—indicative, imperative, optative, suppositive, conjunctive, and infinitive; and there are five tenses—present, imperfect, preterimperfect, preterperfect, and future. The different kinds of verbs are formed as follows: *sewmek*, to love; *sewmemek*, not to love; *sewehmemek*, not to be able to love; *sewilmek*, to be loved; *sewilmemek*, not to be loved; *sewilehmemek*, not to be able to be loved; *sewdürmek*, to make love; *sewildürmek*, to make that somebody is loved; *sewishmek*, to love each other; *sewinmek*, to love oneself, &c. There is a considerable number of irregular verbs. The Turkish construction resembles that of the Latin language, and generally a sentence cannot be perfectly understood till the reader comes to the last word. The Turks form new words by means of composition with as much ease as the Greek, the German, and the Persian: in this respect the Turkish language differs radically from the Arabic.

The Turkish literature is of antient origin. During the reigns of Osman and his successors, a great number of Arabic, Persian, Greek, and Latin works were translated into Turkish. Mohammed II. ordered a translation of Plutarch; Soliman I. had the 'Commentaries' of Cæsar translated; and Aristotle and Euclid were translated in the commencement of Turkish history. Mustafa III. made a translation of the 'Principe' of Machiavelli, and of the 'Anti-Machiavel' of Frederic II., king of Prussia. Some of the works of Boerhaave, Sydenham, Bonnycastle, Vauban, Lalande, Cassini, and, in later times, a great number of English, German, and French works on history, geography, medicine, chemistry, mathematics, and the military sciences, have likewise been translated into Turkish. The original literature of the Turks is valuable, though less so than the Arabic. Jem, the brother, and Selím and Korkud, the sons of Bayazid II.; Soliman II., Ahmed III., and Mustafa III., were distinguished poets, and their works have come down to us. The oldest Turkish poet of renown is 'Ashik-Pasha, who lived during the reign of Osman and Urkhan. The reign of Bayazid II. was distinguished by the following poets:—Nejáti, who was considered the first lyric poet of his time, and who translated several Arabic works into Turkish; Mesíhí, whose 'Ode on the Spring,' translated by Sir W. Jones and by baron Hammer, is known as one of the finest specimens of poetry; A'fitabí, Muniri, Prince Korkud, and the female poet Mihrí, a native of Amasia. Bakí is the greatest Turkish poet. He was three times high judge of Rúm-ili, and died in A.H. 1008 (A.D. 1600); his 'Diwan,' or 'Collection of Poems,' has been translated by Von Hammer under the title 'Bakí's des grössten Türkischen Lyrikers Diwan,' Vienna, 1825. Nabí Efendi, Seyed Refet, and Rághib-Pasha were renowned in the past century. Rághib-Pasha, grand-vizír under Osman III., was equally renowned as an historian and a poet, and his countrymen used to call him 'the Sultan of the poets of Rúm.' The number of historians is very great, and several of them are highly esteemed for their impartiality, judgment, and the concise beauty of their style. Such are 'Ali, the contemporary of Bakí, whose work, 'Kunhol-Akhbár' (Mines of History), finished in A.H. 1006 (A.D. 1597), is one of the best sources concerning the earlier and middle periods of Turkish history: the author speaks with great impartiality about the Christians. Solak-záde has written 'Taríkhi 'Ali Osman li Solak-záde,' a short, but very exact history of the Osmanlis, which finishes with the year A.H. 1054 (A.D. 1644). Pechewí is the author of a history of the period from the accession of Soliman I. (II.) to the year A.H. 1032 (A.D. 1622). Hájí Khalfáh, who died in A.H. 1068 (A.D. 1658), is the author of several excellent works on history and geography, which are written partly in Arabic, partly in Turkish. His 'Takwimuk Tewárikh,' or 'Chronological Tables,' are classical. They were published at Constantinople by the printer Ibráhím, in A.H. 1146 (A.D. 1733), and an Italian translation by Rinaldo Carli was published at Venice as early as A.D. 1697. Hájí Khalfáh's Geography of Rúm-ili and Bosnia has been translated into German by baron Hammer. From the time of Bayazid II., Turkish history has been written by imperial historiographers, a list of whom is contained in Hammer's 'Geschichte des Osmanischen Reiches,' vol. viii., p. 591-92. The best of these historians are—Edris, or Idris (died in A.H. 930; A.D. 1523); Mustafa Jelal-záde (died in A.H. 940; A.D. 1533); Sead-ed-din, who became Mufti (died in A.H. 1007; A.D. 1599): 'Abdi-Pasha Nijánjí (died in A.H. 1102; A.D. 1690); Naïma (died in A.H. 1128; A.D. 1715), whose history contains the period from A.H. 1000 till 1070 (A.D. 1592 till 1659); Rashid continued the history till A.H. 1134 (A.D. 1721); 'Asim, the continuator of Rashid, till A.H. 1141 (A.D. 1728); Subhí continued it till A.H. 1156 (A.D. 1743); Izí till A.H. 1163 (A.D. 1763); and Wassif till A.H. 1188 (A.D. 1774). The annals of Naïma were published at Constantinople in A.H. 1147 (A.D. 1734); those of Rashid in A.H. 1153 (A.D. 1740); those of Subhí in A.H. 1198 (A.D. 1784); those of Izí in the same year; and those of Wassif in A.H. 1188 (A.D. 1774); and afterwards in A.H. 1243 (A.D. 1827). The Annals of Wassif have been partly translated into French by M. Caussin de Perceval.

Among the numerous Turkish biographers, Latifi deserves particular mention. He wrote the lives of about two hundred Turkish poets, one hundred and two of which have been translated into German by Chabert (Zürich, 1800, 8vo.). A list of the works published in Turkish, at Constantinople, is contained in Hammer, cited above, vol. vii., p. 583-595; and a continuation of it, which goes down to the year A.D. 1830, in vol. viii., p. 518-523. The 'Wiener Jahrbücher' contain a list of the Turkish works which were published from A.D. 1830 to the present time.

Turkish literature has been enriched by numerous works on morals, divinity, and philosophy. Their philosophy, which originated from the famous school at Bokhara, has a mystical character, and resembles in many points the speculative doctrines of Schelling, especially with regard to pantheism. More than one Turkish sheikh has proclaimed the possibility of the identification of the soul with God, and the intellectual re-creation of the world, a doctrine which has likewise been professed by Hegel.

(Toderini, *Letteratura Turcha*; Hammer, *Encyclopädische Uebersicht der Wissenschaften des Orients*; Hammer, *Geschichte der Osmanischen Dichtkunst*, 4 vols. 8vo.; the *Turkish Grammars* of Davids, of Jaubert, of Hindoglu; and the *Dictionary* of Kieffer and of Bianchi, as well as the great *Arabic, Persian, and Turkish Dictionary* of Meninski.)

TURKEY, COMMERCE OF. The trade between England and Turkey was for a long period carried on by a chartered company, incorporated in 1581, and invested with exclusive privileges. The members consisted chiefly of eminent London merchants, and retail dealers were excluded. Their charter stated that they had, at their own great costs and charges, found out and opened a trade 'not heretofore in the memory of any man now living known to be commonly used and frequented by way of merchandise.' The fine for admission into the Turkey Company was at first 25*l.* for persons under twenty-five years of age, and 50*l.* for those above that age. No manufactures could be exported to Turkey except in ships belonging to the company, and as these only sailed from London, the trade was entirely confined to that port. A bye-law respecting residence of members practically excluded all but freemen of the city. In the words of Adam Smith, it may be said that the company was 'a strict and oppressive monopoly.' In 1753 the chief abuses were either mitigated or abolished by 26 Geo. II., c. 18. The regulation respecting age and residence was done away with, the fines for admission reduced, and goods were allowed to be imported or exported at any of the ports. The growth of the trade with Turkey occasioned the establishment of an English ambassador there, before any political interest existed between the two countries. The Turkey Company contributed to maintain an ambassador, and two or three consuls, for which they were authorised to levy certain charges on the trade. ('Wealth of Nations,' book v., c. 1.) It was not until 1825 that the company finally surrendered its privileges.

The total declared value of British and Irish produce and manufactures exported to Turkey for the ten years preceding 1841 is given in the following table; and the value of cotton-goods and cotton-yarn exported is separately given, for the purpose of showing the very large proportion which they bear to the total exports:—

	Total Exports.	Cotton Manufactures.	Cotton Yarn.
	£.	£.	£.
1831	888,654	588,808	99,015
1832	915,319	633,440	69,440
1833	1,019,604	752,693	90,052
1834	1,207,941	831,791	109,735
1835	1,331,669	973,377	89,404
1836	1,762,441	1,415,839	112,535
1837	1,158,013	772,965	180,225
1838	1,767,110	1,183,242	241,099
1839	1,178,712	838,106	108,912
1840	1,138,559	743,114	152,774
1841	1,220,261	....	....

It will be seen that in 1838 the exports of cotton manufactures and cotton-yarn amounted to 1,424,343*l.*, or 80 per cent of the total exports, leaving only 342,767*l.* as the value of all other commodities exported. In the same year only four other countries, Brazil, the United States, the East India Company's territories, and Italy, took a larger quantity of cotton goods. The value of the other principal articles exported in 1840 was as follows:—Refined sugar, 63,000*l.*; iron and steel, wrought and unwrought, 56,000*l.*; woollens, 25,000*l.*; machinery and mill-work, 12,000*l.*; coal, 11,000*l.*; plate, jewellery, and watches, 9000*l.*; hardware and cutlery, 8400*l.*; earthenware, 8100*l.*; tin, unwrought, 7800*l.*; tin-ware and tin-plates, 6300*l.*; haberdashery, 4500*l.*; and linens, 2900*l.* The above year presents a fair average of the general course of trade. These official returns, however, do not show the real consumption of English goods in Turkey; but simply the value of goods shipped to the different ports of Turkey Proper, excluding Syria and Palestine, to which the exports of British goods, chiefly cottons, amount to about 250,000*l.* yearly. Mr. Cobden, M.P. for Stockport, and an extensive manufacturer, visited Turkey in 1837, for the purpose of ascertaining, amongst other things, the statistics of the trade with England, and he states that two-thirds of the exports go forward to Persia, and only one-third remains for consumption in Turkey. He estimated the value of British products annually imported into Constantinople for home consumption at 450,000*l.*; British goods carried direct to Smyrna, at 60,000*l.*: imports at Saloniki, 40,000*l.*; imports at Syra, 80,000*l.*; and at other places, 50,000*l.* The total is 680,000*l.*, and this is the value of British products actually consumed in the country. The remainder goes to Persia. The Persian trade was formerly carried on through other channels, by Aleppo, previous to 1790; and afterwards by Bombay for the southern parts, and by the German and Russian fairs for the northern parts. The most direct and economical routes from England are by Constantinople and Trebizond, and nine-tenths of the English goods for Persia are now sent through these two places. (Letter of R. Cobden, Esq., in 'Tait's Magazine,' Feb. 1841.) Besides British products, coffee, indigo, spices, and other foreign and colonial commodities, are shipped from England to Turkey. The English trade with Turkey and the Levant employs about 21,000 tons inwards, and 38,000 tons outwards. The foreign trade in Turkey is in the hands of English, French, Italian, and Greek houses.

The principal articles which Turkey exports to England are raisins, figs, valonia, raw silk, opium, madder-root, sheeps' wool, lamb-skins, cotton-wool, and occasionally wheat. The quantities imported in 1840, and the largest and smallest quantities of the under-mentioned products, imported in any year from 1831 to 1839 inclusive, were as follows:—

		1840.	Highest.	Lowest.
Raisins .	cwt.	54,333	100,458	20,830
Figs .	„	17,863	29,925	7,591
Opium .	lbs.	50,746	177,651	8,184
Silk .	„	725,189	731,905	368,669
Sheeps' wool	„	655,964	2,277,775	11,447
Cotton-wool	„	463,978	660,555	102,433
Valonia .	cwt.	143,095	146,436	58,724

Carpets, leather, and rhubarb are not mentioned in the official tables. Our own looms supply us with carpets; the so-called Turkey leather is made in England; and Turkey does not furnish us with rhubarb. [RHUBARB.] The quantity of tobacco imported from Turkey is small, averaging 22,000 lbs. in 1835-6-7; in the two following years none was imported; and in 1840 only 2000 lbs. It is sold under the name of Syrian tobacco, but the imports direct from Syria are much smaller. The late Sultan established monopolies of valonia, figs, grain, opium, silk, and other articles, under which the coming crops were disposed of at Constantinople to the highest bidder, who compelled the cultivator to sell them at almost any price he pleased to offer. This necessarily checked production, and the continual depreciation of the currency discouraged commerce. Great hopes are entertained that the treaty between Great Britain and Turkey, signed August, 1838, which came into operation March 1st, 1839, will revive industry and give a powerful impulse to commerce. This treaty engages the Porte 'to abolish all monopolies of agricultural produce or of any other articles whatsoever, as well as all permits from the local governors either for the purchase of any article or its removal from one place to another when purchased.' The policy of the Porte in respect to importation had always been liberal, and the above treaty gives the same facilities to the internal and export trade. English merchants trading within the Ottoman dominions are allowed under this treaty to purchase, export, or re-sell all kinds of merchandize. Other powers are entitled to establish their trade with Turkey on the same basis as that laid down in the British treaty. The duties it fixes are three per cent. on all commodities imported or exported, and they are to be subject to a septennial revision on the demand of either party.

TURKEY BERRIES. [RHAMNUS.]

TURKEY BUZZARD. *Vultur aura*, Linn.; genus *Cathartes*, Ill.

Under the name of *Vultur aura*, two species at least have been confounded, one the true *V. aura*, and the other the *Urubu, Vultur atratus;* the former is figured by Wilson, pl. 75, f. 1, and the latter in the same plate, f. 2.

Mr. Swainson thus defines the genus *Cathartes*:—

Nostrils naked, longitudinal. Wings with the third quill equal to the fourth, and longest. Inhabits, with one exception, the New World. Typical.

The following subgenera are arranged by Mr. Swainson under this genus:—

Sarcoramphus [CONDOR]; and *Cathartes*.

The subgenus *Cathartes* is thus characterised:—

Head and part of the neck naked, but without caruncles. Bill and general construction weaker than in *Sarcoramphus:* species *C. aura*, *C. californianus*, and *C. atratus*.

Linnæus describes his *Vultur aura* as a 'grey-brown vulture, with the quills black, and the beak white,' and he gives the following synonyms:—*Tzopilotl s. aura*, Hernand., Mex.; *Urubu* of the Brazilians, Marggr., Willughby, Ray; *Buteo specie gallo-pavonis*, Catesb.; *Vultur gallinæ Africanæ facie*, Sloane; *Vultur brasiliensis*, Briss.; *Vultur pullus, capite implumi, cute crassâ rugosâ ultra aperturas nasales laxatâ*, Brown. The habitat is stated to be the warmer parts of America. Then follows an account of the habits from Jacquin, and the following

Description.—Body black, shining with purple and green; the irides croceo-cærulescent; the feet flesh-coloured; the head rufescent.

Here the species are confounded. We will now trace the history.

The passage in Willughby referred to by Linnæus is as follows:—'The Brazil vulture called *Urubu;* by the Dutch *Een Menscheneter*, Marggrav.; by the Mexicans, *Tzopilotl* F. Ximen.; by Nieremberg and others, *Aura*.

'It is a rapacious bird: of the bigness of a kite, according to Marggravius; of a middle-sized eagle or raven, according to Ximenes: having whitish feet like a hen's, a long tail, and wings longer than it. The feathers of the whole body are black, with a little tauny-colour here and there mingled. It hath a small head, almost of the shape of a turkey's, covered with a somewhat ragged or wrinkled skin. In the top of the head the skin is, as it were, divided long-ways, and on the left side of the head, beneath the eye, is of a saffron-colour, above the eye of a blew, also in the top; elsewhere of a reddish-brown. In the right side of the head about the eye, above and beneath, it is of a saffron colour, as also in the top: elsewhere of a delayed yellow or whitish. It hath a pretty long bill, hooked at the end, sharp, and covered over from the head half-way with a skin from saffron-colour tending to blue. In the middle of the bill, above, is one hole of the nostrils, large and situate transversely. The end of the bill, that is bare and wants the skin, is white. It hath elegant eyes, almost of the colour of a ruby, with a round black pupil: the eyelids of a saffron colour. The tongue carinated and indented round with sharp teeth. Its flesh stinks like carrion. For they feed upon dead carcasses; and in the Capitania (chieftainship) of Sirigippo and river of St. Francis, when any one kills a beast, they come flying presently in great numbers. It is an ill-looked bird, always lean, and never satisfied: Ximenes makes it to be a kind of raven, but the sear or skin covering the basis of the bill argues it to belong to the rapacious kind; the bare head, and tip of the bill only hooked, determine it to be of the family of vultures. It feeds (saith Ximenes) upon dead flesh and man's dung. They pearch at night on trees and rocks, in the morning they resort to the cities, sit viewing and watching the streets on high places, and when they spy any filth, garbidge, or dead thing, they catch it up and devour it. Where they build or hatch their young is hitherto unknown, although they be most frequent in almost every corner of New Spain. Yet Acosta saith that their young ones are white, and that growing up they change and come to be as black as ravens. They fly always very high, and cast a horrible stink from them like ravens. They fly constantly in flocks, and sit upon trees, and feed joyntly in company upon dead carcasses without any strife or quarrelling; and when the rest see any one not able to move or help herself, they help her as much as they can, and bring her to the water; for being washed they recover strength to fly. If any one pursues them, they empty themselves presently, that they may be more light to fly away; with like haste casting up what they have swallowed. The ashes of their feathers burned take away hairs so that they come not again; which faculty is also attributed to the dung of pismires and the bloud of bats. Their skin half-burnt heals wounds if it be applied, and the flesh withal eaten; which is also wont to help those that are sick of the French pox. The heart dried in the sun smells like musks. The dung dried and taken in any convenient vehicle to the weight of a drachm is profitable to melancholy persons. The barbarous persons say that wherever they lay their eggs, they compass their nests with certain pebble-stones, which promote transpiration. But the more probable opinion is, that they exclude their young underground, and take them out when they feed them, and again cover them in the earth.' (1678.) Fable, as we see, had been busy here.

Sir Hans Sloane, in his 'Jamaica' (1725), names the bird which haunts that island, in his index, both 'Carion Crow' and 'Turkey Buzzard.' In the text he designates it as 'the Carion Crow,' and figures it under that title superscribed with 'Vultur Gallinæ Africanæ facie.' He adds to the synonyms given by Willughby, 'Cozæquauhtli of Hernandez,' an evident misprint for 'Cozcaquauhtli; but the *Cozcaquauhtli* appears to be the *Vultur Papa* of Linnæus, and Sloane himself saw that it could not be his turkey-buzzard.

This is Sloane's description of the 'Carion Crow:'

'This is, from the end of the bill to that of the tail, two foot long, and twice as much from the end of one wing to that of the other extended. The head and an inch in the neck are bare and without feathers, of a flesh-colour, covered with a thin membrane, like that of turkeys, with which the most part of the bill is covered likewise; this skin on the upper part of the neck is crumpled or wrinkled. It has two large nostrils; the bill is more than an inch long, and crooked at the point, where 'tis whitish and sharp; the tail broad and nine inches long; the toes four, three before and one behind; that in the middle before is more than an inch long, covered with ash-coloured scales, and armed with brown blunt claws; 'tis all over of a dark brown colour, except the under side of the wings and tail, which is of a light brown or grey. It flies exactly like a kite, and preys on nothing living; but when dead it devours their carcases, whence they are not molested. They are to be found everywhere. At the first landing of the English on Jamaica, by the bareness and colour of the skin on the head, they took this bird to be a turkey, and killed several of them in several places for such, but soon found themselves deceived with their stinking and lean bodies, which they almost always have. The figure of Hernandez does not agree with this, neither does his description agree with his figure.' Sir Hans Sloane then quotes Hernandez for the medical virtues supposed to be resident in the bird above noticed, and Ximenes, who states that it maintains itself principally upon snakes, 'rattones,' and lizards, which it takes, and that it resists the violence of the winds wonderfully, keeping itself against them without motion.

Catesby (1771), who gives the same synonyms, figures the 'Buteo specie gallo-pavonis, Turkey-buzzard,' and thus describes it:—

'This bird weighs four pounds and a half. The head and part of the neck red, bald, and fleshy like that of a turkey, beset thinly with black hairs; the bill is two inches and a half long, half-covered with flesh, the end white, and hooked like that of a hawk, but without angles on the sides of the upper mandible; the nostrils are remarkably large and open, situated at an unusual distance from the eyes; the feathers of the whole body have a mixture of brown, purple, and green; the legs are short, of a flesh-colour; their toes are long, shaped like those of dunghill-fowls; their claws black, and not so hooked as those of hawks.

'Their food is carrion; in search after which they are always soaring in the air. They continue a long time on the wing, and with an easy swimming motion mount and fall, without any visible motion of their wings. A dead carcase will attract together great numbers of them; and it is pleasant to observe their contentions in feeding. An eagle sometimes presides at the banquet, and makes them keep their distance while he satiates himself.

'These birds have a wonderful sagacity in smelling; no sooner there is a dead beast but they are seen approaching from all quarters of the air, wheeling about, and gradually descending and drawing nigh their prey, till at length they fall upon it. They are generally thought not to prey on anything living, though I have known them kill lambs, and snakes are their usual food. Their custom is to roost many of them together on tall dead pine or cypress trees, and in the morning continue several hours on their roost, with their wings spread open, that the air, as I believe, may have the greater influence to purify their filthy carcases. They are little apprehensive of danger, and will suffer a near approach, especially when eating.' (*Carolina.*)

Browne (*Jamaica*, 1789), in the index to the work, refers *Vultur aura* to the 'Carrion Crow' of Sloane, the 'Turkey-buzzard' of Catesby, with the following description:—

'This bird is rather smaller than a turkey-pout, which it resembles very much both in the form and appearance of the head; the apertures of the nose are very large, stretched lengthways, and lined with a loose red skin that covers all the upper parts of the beak. We know no creature that has the sense of smelling so exquisite as this: it generally flies very slow and with its wings expanded, waving of one side and the other as it moves against the wind; and it soon discovers by the subtile exhalation where any carrion lies. It is of service to the country in general by preventing the putrefaction and infection arising therefrom of such creatures *as die among the bushes*, and the slops that are generally thrown carelessly into the streets, &c., and the legislative body of the island were so sensible of this, that they have carefully provided for its safety, as a bird of general use and benefit to the island. These birds are of a very alkalescent nature, and stink much in a few minutes after they are killed. They are no great breeders.'

The bird described by Sloane, Catesby, and Browne is still to be seen in Jamaica enjoying the immunity which its disgusting but salutary services have earned for it, and which has made it so familiar; and this bird we believe to be the true *Vultur aura*. Both Sloane and Browne speak of its powerful sense of smelling, and we have printed in Italics a few words from the description of the latter, which would indicate that smell has at least as much to do with the discovery of the prey as sight, notwithstanding some strong opinions to the contrary. [Birds, vol. iv., p. 429.] With a view to the investigation of this question, it becomes of importance to ascertain the development of the olfactory nerves in this species, and this information is afforded by Professor Owen, who, in 1837, laid before the Zoological Society of London the following dissection of two heads of 'John Crow,' which he supposes to be the *Vultur aura*, or *Turkey Buzzard*. Professor Owen dissected the olfactory nerves in these heads, and also in a Turkey, which seemed to him to be a good subject for comparison, being of the same size, and one in which the olfactory sense might be supposed to be as low as in the *Vulture*, on the supposition that this bird is as independent of assistance from smell in finding his food as the experiments of Audubon appear to show. 'There is, however,' says Professor Owen, 'a striking difference between the *Turkey-Vulture* and the *Turkey* in this part of their organization. The olfactory nerves in the *Vulture* arise by two oval ganglions at the anterior apices of the hemispheres from which they are continued 1½ line in transverse diameter, and two lines in vertical diameter, and are distributed over well-developed superior and middle spongy bones, the latter being twice the dimensions of the former. The nose is also supplied by a large division of the supraorbital branch of the fifth pair, which ascends from the orbit, passes into the nose, crossing obliquely over the outer side of the olfactory nerve, extending between the superior spongy bone and the membrane covering the middle spongy bone, then descending, and, after supplying the inferior and anterior spongy bone, escaping from the nasal cavity to supply the parts covering the upper mandible. This olfactory branch of the fifth pair is about one-fourth the size of the true olfactory nerve.

'In the *Turkey* the olfactory branch of the fifth nerve is about the same size as in the *Vulture*, and is superior in size to the true olfactory nerve, which is only about one-fifth the size of that in the *Vulture*. The olfactory nerve does not form a ganglion at its commencement, but is continued as a small round chord from the anterior apex of each hemisphere, and is ramified on a small middle spongy bone, there being no extension of the pituitary membrane over a superior turbinated bone, as in the *Vulture*. Indeed the difference in the development of the nasal cavity is well marked in the different forms of the head in these two species. In the *Vulture* there is a space between the upper parts of the orbits, in which the olfactory ganglions and nerves are situated; and the nasal cavity, anterior to these, is of a much greater breadth and also longer, as well as exhibiting internally a greater extent of pituitary surface than in the *Turkey*. In this bird the olfactory nerves are compressed within a narrow interorbital space, which would not admit of the lodgment of ganglions; the olfactory nerves, after passing through this space, then diverge to the nasal cavity.

'In the *Goose* the olfactory nerves are developed to the same size as in the *Vulture*, and expand upon superior spongy bones of similar form, but placed wider apart, and these supply the middle spongy bones, which are longer, but not so broad as in the *Turkey*. The olfactory branch of the 5th pair is double the size of that in the *Vulture* or *Turkey*: it gives, however, not a greater proportion of filament to the nose than in those birds, but is mainly expended upon the membrane covering the upper mandible.'

Professor Owen concludes by observing that the above notes show that the *Vulture* has a well-developed organ of smell, but whether he finds his prey by that sense alone, or in what degree it assists, anatomy is not so well calculated to explain as experiment. (*Zool. Proc.*, March 1837.)

At the same meeting before which Professor Owen's notes were read, experimental evidence was also produced in a paper by Mr. W. Sells, 'On the Habits of the *Vultur aura*.'

Mr. Sells remarks that this bird is abundantly found in the island of Jamaica, where it is known by the name of *John Crow;* and so valuable are its services in the removal of carrion and animal filth, that the legislature have imposed a fine of 5*l.* upon any one who destroys it within a stated distance of the principal towns. Its ordinary food, he says, is carrion, but when hard pressed with hunger it will seize upon young fowls, rats, and snakes. He notices the highly offensive odour emitted from the eggs of this species when they are broken, and then relates the following instances, from personal observation, for the purpose of proving that the *Vultur aura* possesses a very acute sense of smell.

'It has been questioned,' says Mr. Sells, 'whether the vulture discovers its food by means of the organ of smell or that of sight. I apprehend that its powers of vision are very considerable and of most important use to the bird in that point of view; but that it is principally from highly organized olfactories that it so speedily receives intelligence of where the savoury morsel is to be found, will plainly appear by the following facts:—In hot climates the burial of the dead commonly takes place in about twenty-four hours after death, and that necessarily, so rapidly does decomposition take place. On one occasion I had to make a post-mortem examination of a body within twenty-four hours after death, in a mill-house completely concealed, and while so engaged, the roof of the mill-house was thickly studded with these birds. Another instance was that of an old patient and much-valued friend who died at midnight. The family had to send for necessaries for the funeral to Spanish Town, distant thirty miles, so that the interment could not take place until noon of the second day, or thirty-six hours after his decease, long before which time—and a most painful sight it was—the ridge of the shingled roof of his house, a large mansion of but one floor, had a number of these melancholy-looking heralds of death perched thereon, besides many more which had settled in the vicinity. In these cases the birds must have been directed by smell alone, as sight was totally out of the question.

'In opposition to the above opinion,' continues Mr. Sells, 'it has been stated by Mr. Audubon that vultures and other birds of prey possess the sense of smell in a very inferior degree to carnivorous quadrupeds, and that so far from guiding them to their prey from a distance, it affords them no indication of its presence, even when close at hand. In confirmation of this opinion he relates that he stuffed the skin of a deer full of hay and placed it in a field: in a few minutes a vulture alighted near it and directly proceeded to attack it, but finding no eatable food he at length quitted it. And he further relates that a dead dog was concealed in a narrow ravine twenty feet below the surface of the earth around it, and filled with briers and high canes; that many vultures were seen sailing in all directions over the spot, but none discovered it. I may remark upon the above experiments, that in the first case the stag was doubtless *seen* by the birds, but it does not follow that they might not have smelt the hide, although inodorous to the human nose; in the second case the birds had undoubtedly been attracted by *smell*, however embarrassed they might have been by the concealment of the object which caused it. I have in many hundred instances seen the vulture feeding upon small objects under rocks, bushes, and in other situations, where it was utterly impossible that the bird could have discovered it but through the sense of smell, and we are to recollect that the habit of the vulture is that of soaring aloft in the air, and not that of foraging upon the ground.'

The truth is, that both senses, sight and smell, aid the vulture in directing it to its prey; and the olfactory and visual organs are developed accordingly.

Mr. Darwin (*Journal*, 1839), after a most interesting account of the habits of the Caracaras (*Polyborus*), says, 'We have now only to mention the Turkey-buzzard (*Vultur aura*) and the Gallinazo. The former is found wherever the country is moderately damp, from Cape Horn to North America. Different from the *Polyborus Brasiliensis* and *Chimango*, it has found its way to the Falkland Islands. The Turkey-buzzard is a solitary bird, or, at most, goes in pairs. It may at once be recognised from a long distance, by its lofty, soaring, and most elegant flight. It is well known to be a true carrion-feeder. On the west coast of Patagonia, among the thickly-wooded islets and broken land, it lives exclusively on what the sea throws up, and on the carcasses of dead seals. Wherever these animals are congregated on the rocks, there the vultures may be seen. The Gallinazo (*Cathartes atratus*) has a different range from the last species, as it never occurs to the southward of lat. 41°. Azara states that there existed a tradition that these birds, at the time of the conquest, were not to be found at Monte Video, but that they subsequently followed the inhabitants from the more northern districts. At the present day they are numerous in the valley of the Colorado, which is three hundred miles due south of Monte Video. It seems probable that this additional migration has happened since the time of Azara. The Gallinazo generally prefers a humid climate, or rather the neighbourhood of fresh water: hence it is extremely abundant in Brazil and La Plata, while it is never found on the desert and arid plains of Northern Patagonia, excepting near some stream. These birds frequent the whole Pampas to the foot of the Cordillera, but I never saw or heard of one in Chile: in Peru they are preserved as scavengers. These vultures certainly may be called gregarious, for they seem to have pleasure in society, and are not solely brought together by the attraction of a common prey. On a fine day a flock may often be observed at a great height, each bird wheeling round and round without closing its wings, in the most graceful evolutions. This is clearly done for sport-sake, or perhaps is connected with their matrimonial alliances.'

Nidification, &c.—Nuttall remarks that the Turkey-buzzard has not been known to breed north of New Jersey in any of the Atlantic States; and he says that they seek out the swampy solitudes, and, without forming any nest, deposit from two to four eggs in the stump of a hollow tree or log, on the mere fragments of rotten wood with which it is ordinarily strewed. Occasionally, in the Southern States, they have, he tells us, been known to make choice of the ruined chimney of a deserted house for this purpose. The eggs, which are described as being larger than those of a turkey, are yellowish-white, blotched irregularly with dark brown or blackish spots, at the larger end chiefly. The male often attends while the female is sitting; and, if not materially disturbed, they will continue to occupy the same place for several years in succession. The young, which are covered with a whitish down, will, like their parents, eject the filthy contents of their stomachs over those who molest them. (*Manual of the Ornithology of the United States and of Canada.*)

Turkey-Buzzard.

TURKEY-HONE. *Whetslate: Novaculite.*—Occurs massive, with a slaty structure. Colour commonly greenish-grey, sometimes yellowish or brownish-grey. It is translucent on the edges, yields to the knife, and is somewhat unctuous to the touch. Specific gravity 2·7. When cut and polished, it is used for sharpening small cutting instruments, whence its name.

It occurs on primitive mountains at Lauenstein, in Bayreuth, in Saxony, and near Freyberg. It was first brought to Europe from the Levant. A specimen from Iconium in Asia Minor, analysed by Mr. Holme, yielded—

Silica . . .	72
Lime . . .	13·3
Alumina . .	3·3
Carbonic acid . .	10·3
	98·9

TURKISTAN (a name formed upon the same principle as Afghanistan, Beluchistan, and others) means the 'country of the Turk,' and is used to designate a region peopled by the tribes of that race, or in which it is at least the dominant race. The name has been applied at different times to different regions: sometimes it has designated a narrower, sometimes a more extensive range of country. At present its recognised limits are nearly as follows:—

Lake Sir-i-kol, the principal source of the Amu-deria (Oxus), has been ascertained, by Lieut. Wood, to be situated in 37° 27′ N. lat. and 73° 40′ E. long. Due south of this lake the summit ridge of the mountains which divide the affluents of the Amu from those of the Indus appears to be situated nearly in 37° N. lat. The southern boundary of Turkistan is formed by a line passing through this point to the south of west along the summit range to the pass of Khawak (35° 37′ N. 70° E.), thence to the pass of Akrobat, north of Bamian, and thence to the north of west between Meimuna and Herat, till it reaches the frontier of Persian Khorasan. This line is prolonged to the eastward along the summit ridge of the Muz-tag and Kara-korum mountains to the eastern termination of the latter on the high plain of Chang-thung, north of the sources of the Shaiyok, or northern branch of the Indus; the direction of the frontier of Turkistan to the eastward of this point and the longitude of its eastern termination are uncertain. The western frontier of Turkistan south-east of the Caspian is vague and unsettled: it stretches among the hills at the base of the Elborz Mountains, passing through Muzderan, a station 38 miles from Meshed (36° 17′ 40″ N., 59° 35′ 27″ E.) on the road to Sherrukhs (36° 31′ N.), and thence winding westwards along the upper valley of the Attruk and the valley of the Gurgan to the Caspian about 20 miles north-west of Astrabad (36° 51′ N., 54° 25′ E.). Northward of the mouth of the Gurgan, the eastern shore of the Caspian, and the course of the Ural River from Uralsk (51° 11′ 49″ N., 51° 22′ 7″ E.) to its mouth below Guriev (47° 6′ 37″ N., 51° 38′ 59″ E.), form a precise and well-defined boundary on the west. The northern frontier of Turkistan is defined by the Russian chain of posts extending from Uralsk on the Ural, to Krasnoyarsk on the Irtish. The subjoined table of positions of some principal stations on this line indicate its extent and direction:—

	N. lat.			E. long.		
	°	′	″	°	′	″
Uralsk . .	51	11	49	51	22	7
Orenburg .	51	45	51	55	6	39
Orsk . .	51	12	0	58	25	24
Troitsk . .	54	4	45	62	3	24
Petropolovsk .	54	52	23	69	42	13
Omsk . .	54	59	7	73	55	27
Semipolatinsk .	50	23	32	80	45	54
Ustkamenogorsk	49	56	15	83	7	37
Krasnoyarsk .	49	14	55	84	42	9*

From Krasnoyarsk the eastern frontier extends in a direction to the west of south along the Chinese provinces of Tarbagatai and Guldja-ili to the south-west angle of the latter [SONGARIA], and thence eastwards along the summit ridge of the Thian-shan Mountains to the meridian of the lake called Lop-Nor. [THIAN-SHAN MOUNTAINS.] The further extension of this frontier, till it meets the southern boundary-line, is, like the eastern extension of the latter, entirely unknown.

In attempting to give a picture of the physical conformation of the region contained within these limits, it will be advisable to begin at the lake Sir-i-kol (visited by Lieut. Wood) on the high table-land of Pamir, near the southern frontier of Turkistan. The lake is of a crescent form, about 14 miles long from east to west, with an average breadth of one mile. By the boiling-point of water it appears to be 15,600 feet above the level of the sea. It is bordered by hills on three sides; those on the south rise to the estimated height of 3500 feet above the level of the lake. The Amu flows from its western extremity first in a south-west direction till it reaches the parallel of 36° 50′ a little east of the meridian of 71°; then to the north-west till it reaches the parallel of 37° 50′, a degree farther west; and again south-west to Hazrat Imam, a little more to the south than Sir-i-kol, in longitude 69° E. The bed of the Amu is here, according to a statement in the 'Asiatic Journal' (November, 1838), about 500 feet above the level of the sea, and here are the lowest fords on the river. As far as the meridian of 68° E. the passes across the mountain-range which extends south-west from Sir-i-kol do not sink lower than 13,000 feet above the level of the sea. Twenty-five miles west of the lake the bed of the Amu is 1200 feet below its level; 35 miles farther west it is only 10,000 feet above the sea. The village of Robat, on the banks of a southern affluent of the Amu, 60 or 70 miles west of this latter point, is 8100 feet above the sea. The crest of the pass east of Talishkan is 6600 feet above the sea.

These elevations indicate that the general level of the land south of the Amu above its lowest fords immediately attains a high level; it is in fact an elevated plain furrowed and intersected by numerous deep narrow valleys down which flow the Kokcha and Kunduz rivers (and their affluents), the two principal tributaries of the Upper Oxus, which join it, the former about 30 miles east of Hazrat Imam; the latter about as far west of that place. In the low ridge at the east end of Sir-i-kol a river which runs to the north of east to Yarkand has its rise; and Lieut. Wood was informed that from the sources of the Yarkand and Amu rivers the country sloped down on every side except to the south-east. The high ground north of the Amu at the mouth of the Kokcha is at a greater distance than that on its south, and does not rise so high. At Kurshi however, 2° farther north, Sir A. Burnes saw mountains covered with snow in July about 150 miles to the west, which would be nearly in the meridian of the mouth of the Kokcha. Their summits must have been about 18,000 feet above the sea; they continued in sight nearly at the same distance for about seven hours, and they 'ran in a connected chain like a trap formation'—an expression which, of course, must be understood to imply only their form, not the ingredients of their rocks. Lieut. Wood was informed that the Sir-deria (Jaxartes) had its rise on the north side of the ridge of hills extending westward from the north side of the Sir-i-kol, opposite Issar, which is about 70 miles south-west of the lake. The Zer-afshan, which flows by Samarcand and Bokhara, is said to have its sources not far distant from those of the Sir-deria. From the latitude of Kurshi (38° 52′ N.) the high land seen by Burnes appears to stretch to the north-east, to beyond the meridian of Samarcand (about 67° E.). North of the Zer-afshan the high land appears to continue as far west as the meridian of Bokhara (64° 55′ E.); at least Meyendorf speaks of a mountain which retains snow on its summit during the greater part of the year, and is visible from Bokhara, as lying north of that town. About the meridian of 68½° E., and the parallel of 41° N., the Sir-deria, which flows to that point in a direction a little north of west from its source, turns to the north. The high land comes nearly close up to the east bank of the river in this part of its course, but does not appear to continue farther north, at least within the limits of Turkistan, than the ridge which separates the lake called Issi-kol from the Balkash lake (about 42° N.). In our state of imperfect information, Yarkand (according to Hallerstein, 38° 19′ N., 76° 18′ E.) and Kashgar (39° 25′ N., 73° 56′ E.), which appear to have an extensive plain to the east, and are evidently on a much lower level than the country to the west of them, may be assumed as the eastern limit of the high table-land of Pamir. From Kashgar to Kokand (according to Felix d'Arocha, 41° 23′ N., 70° 26′ S.) the road lies up the Kashgar river to its source, and through the pass of the Terek to the valley of the Sir-deria. Mir-Izzet-Ullah was informed that a road conducted in winter from the Terek pass to Sir-i-kol (whether the lake visited by Lieut. Wood was meant, or a town of that name on the Yarkand river is uncertain) in two or three days; in summer the road was said to be impassable on account of torrents fed by the melted snow. Mir-Izzet-Ullah did not experience, even at the highest part of the Terek pass, any of the painful symptoms he had felt on passing the high range of Karakorum; and this fact corroborates the account given to Lieut. Wood, that the high table-land of Pamir slopes down on the north towards Kokand.

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* These, with the exception of Orsk (taken from the maps of Meyendorf and Levshin), are the latitudes and longitudes of Humboldt. The longitudes of the positions east of Tobolsk (65° 58′ 55″ E.) depend upon the longitude of that town ascertained by the Abbé Chappe's observation of the transit of Venus in 1761. Lieut. Euler observed the transit of Venus in 1769 at Orsk.

At the western base of this enormous table-land is the broad valley of the Oxus: at its eastern base is the plain which extends between the high land of Tibet on the south and the Thian-shan on the north, as far as lake Nor; and north of it is the comparatively low country which slopes from the plains of Songaria westward to lake Aral and the Caspian. These three natural divisions of Turkistan will be described in the order in which they are here enumerated.

Under the designation Plain of the Oxus is embraced the level tract extending from the base of the mountains east of Kurshi (68° E. long.) to the shores of the Caspian (54° E. long.), and from the shores of the Aral (about 44° N. lat.) to the south of Balkh (about 36½° N. lat.). From the junction of the river of Kunduz with the Amu Deria the latter river maintains a generally north-west direction till it loses itself in the sea or lake called Aral. The junction of the rivers is placed by Lieut. Wood about 37° N. lat. and 68½° E. long.; the mouths of the Amu Deria are placed by Zimmermann, from numerous but not very specific routes, about 43½° N. lat. and from 56° to 57° E. long. Below the junction of the Kunduz the Amu receives no affluents of any magnitude; the rivers of Kulm, Balk, Herat, and Meshea, Kurshi and Bokhara, are either absorbed by the dry desert or by canals of irrigation before they can reach it. Wood forded the Amu at Jan-Kila, a short way above its junction with the Kokcha. The stream was here divided into three channels. The northern channel was 200 yards wide and had a velocity of 4 miles an hour; the centre one was about half the breadth, with a current of about 3 miles; the water of the southern channel was almost stagnant. A man on foot could not have forded the river here; and fewer than three horses abreast could with difficulty stem the current. At the ferry between Balkh and Kurshi, Burnes found the Amu about 800 yards across, with an average depth of 20 feet, and a current of 3½ miles an hour. At Charjui, on the road from Bokhara to Meshed, he found the river 650 yards broad, and in some places 25 and 29 feet deep. Dr. Lord has stated that the elevation of Kunduz (nearly the same as that of Hazrat Imam) is 498 feet above the sea; and a barometrical levelling by Russian officers, in the winter of 1825, gives the height of lake Aral above the Caspian 117 feet, and consequently its height above the Black Sea, according to the trigonometrical levelling of Fuss, Savich, and Sabler, 33 feet. From the banks of the Amu to the Elborz on the south-west, and to the snowy mountains east of Kurshi on the east, extends an immense plain, the elevation of which, towards its southern extremity, is at Balkh 1718 feet above the level of the sea, and at Khulm 1437. At Bokhara its elevation is 1201. The elevation of Meshed, as deduced by Fraser, from the boiling-point of water (2652 feet), would lead to the inference that Sherrukhs and the ford on the Murghab, between the Amu and Meshed on the road from Bokhara, are at least as much elevated above the sea as the latter city. The northern boundary of this plain is formed by a ridge of high broken ground north of Bokhara, which extends from the eastern mountains to the Amu above Khiva; west of the Amu it is bounded to the north by the Aral and by the abrupt termination of the Ust-urt, a high table-land rising precipitously from the banks of the Aral and the Caspian, to an average level of nearly 600 feet above the latter, occupying the whole breadth of 138 miles between the seas, and extending south of the southern termination of the Aral, almost to the 41st degree of N. lat. Between the termination of the Ust-urt and the route pursued by Burnes from Bokhara to Meshed (between 37° and 39° N. lat.) we have literally no information respecting the plain east of the Amu; but the height of the shores of the Caspian, at the bay of Balkhan, the height of the ridge of hills crossed by Muraviev on his way from the Balkan to Khiva, the apparent rise of the ground eastwards along Lieutenant Conolly's route, and the fall of the water in the lower Attreck, all point to the inference that the central plain maintains a considerable elevation from Sherrukhs to the base of the Ust-urt, that the maximum depression of the level of the basin of the Caspian extends a very little way to the eastward, and that there is no reason to believe that the Amu ever did or could send a branch to the Caspian since the surface of our globe assumed its present configuration.

In describing the superficial form of the wide tract extending from the shores of the Aral to the Caspian, and the Russian and Chinese frontiers, better known as the Steppe of the Kirghiz, we begin at the Russian frontier. From Orsk to Uralsk (from 58½° to 51½° E. long.), about the 51st parallel of latitude, the course of the Ural river is nearly east and west, and in that distance its bed sinks from an elevation of 582 feet to one of about 200 feet above the level of the sea. From Orsk to Guriev, near the Caspian (47° 6′ N. lat.), the direction of the Ural is nearly south, and in this part of its course the river sinks to an elevation of 140 feet above the sea at Kalmukovah, and to nearly 82 feet below it at Guriev. The steppe on the south bank of the Ural, between Orsk and Uralsk, appears to rise immediately to an average elevation of 500 to 800 feet. Mount Airuk, 224 miles south-east of Orenburg, the highest summit of the Mongojar hills, rises 800 to 1000 feet above the level of the steppe. From this culminating point the ground slopes, still in a south-east direction, gradually down to the level of the Aral, a distance of 300 miles. To the south-west the ground sinks gradually to the level of the Ust-urt, which appears to be a prolongation of this comparatively elevated land. The Emba, which flows south-west to the Caspian, the Uil, which flows west till it is lost in the sands east of the Lower Ural, the Khobda and Ilek, which flow to the north of west, and after uniting their streams fall into the Ural midway between Uralsk and Orenburg, and the Or, which flowing to the east of north joins the Ural at Orsk, all rise on the sides of Mount Airuk. The eastern base of the Mongojar range is washed by the Irghiz, which, rising in an undulating plain south of the sources of the Tobol, nearly in lat. 51°, flows to the south and loses itself in a chain of lakes called Ak-sakal, about 60 miles north-east of the north-eastern corner of lake Aral. From the sources of the Irghiz and Tobol, about 60° E. long., to those of the Turghai, about 3° to the eastward, there extends a plain considerably elevated above the level of the ocean, but considerably depressed below the hilly countries to the east and west of it, covered with a multitude of salt lakes, and sending its waters southward to lake Ak-sakal, northward to the Tobol and Ishim, both affluents of the Irtish. The numerous streams which unite to form the Turgai rise about 64° E. long., over a range of country extending from about 49° to 52° N. lat., and converging into one main stream flow westwards to the Ulkiak, which coming from the north joins the Irghiz near its termination in Ak-sakal. The course of the upper rivulets of the Turgai appears to form the western termination of a belt of high land which extends in a north-western direction, parallel to the course of the Irtish, between Ust-Bukhtarminsk and Omsk, from the high lands between the Nor-Saisan and Tarbagatai, about 85° E. long., to the meridian of 64° E. long. From its outlying hills on the north, about 100 miles from the banks of the Irtish, to its southern base, this high land must have a horizontal breadth of nearly 180 miles. Its central ridges reach an estimated elevation of at least 5000 to 6000 feet above the sea. To the north it sends out the Ishim, which joins the Irtish, the Nura (south-west of the Ishim), the Selenta, Ulenta, Chanderli, and other rivers (east of that river) which lose themselves in the steppe lakes before they reach the Irtish. To the south this high land sends forth the Ainguz, the Jurgutu, and some other rivers which fall into the lake Balkash on the Chinese frontier; and the Sari-su (its sources appear to be about 47° N. lat. and 72° E. long.) and the Kongur (its sources appear to be about 49° N. lat. and 65° E. long.), which meet about 47° N. lat. and 67° E. long., and from their point of junction flow south-west till they are lost in brackish lakes about 40 and 50 miles from the Sir-Deria (about 45½° N. lat. and 66° E. long.). The Tshui, which is believed to issue from lake Issi-kol, at the northern base of the Thian-Shan range, about 42° N. lat. and 81° E. long., flows in a north-west direction till it is lost in a salt lake a little to the south of that which receives the united streams of the Kongur and Sari-su. The hills south of Issi-kol extend westward from the meridian of that lake to the Sir-Deria, about 69° E. long. In this longitude their northern base is about 46 miles south of the Tshui, and their horizontal breadth about 54 miles. The Sir-Deria flows at their southern base to 69° E. long., then turns and flows past their termination to the north till it reaches within a degree of latitude of the lakes in which the Tshui terminates; hence it bends away to the west and flows to lake Aral in 61° E. long. The apex of the delta of the Sir-Deria is not less than 5° to the east of the shores of the Aral; the most northerly branch joins that lake not far from its north-east angle, about 46° N. lat., and the most southerly near its south-east angle, about 43½° N. lat. The mountains which intervene between the upper valley of the Sir-Deria and the valley of Samarcand, and the hills which extend from their western termination to the Amu, form the extreme southern boundary of the Kirghiz Steppe, between 42° and 43° N. lat. The watercourses of the tract west of lake Aral show that there is a general slope from the high lands in which the Kongur and Sari-su have their sources on the north, and from the mountain-ranges south of lake Issi-kol on the south, towards the centre of the plain which lies between them; and that the central depression of this plain has a general slope from the level of lake Balkash to the Aral. Humboldt estimates the elevation of lake Balkash as not more than 800 feet above the ocean, but as this estimate was made at the time when very exaggerated notions were entertained of the depression of the Caspian, perhaps 1000 feet will be nearer the truth. The Aral, it has been seen, is probably about 33 feet above the level of the Black Sea.

Very little is known of that extensive range of country which lies east of the great elevation of Pamir, and has been called by recent geographers Chinese Turkistan. The Thian-shan extends along its northern side, from the junction of the range with Pamir to its junction with the high desert plain of the Gobi—from the meridian of 71° or 72° E. long. to that of 89°, and the high land of Tibet along its southern side. Lop-Nor appears to form its eastern boundary. The accounts of travellers seem to establish that both Kashgar and Yarkand stand on a plain much depressed below the level of the highlands to the north, south, and west of them. Kashgar, according to Hallerstein, is in 39° 25′ N. lat. and 73° 56′ E. long.; Yarkand in 38° 19′ N. lat. and 76° 18′ E. long. A river flows past Kashgar, formed by two streams, one of which comes from the pass of Karakorum on the road to Ladak; the other from a range of hills at the east end of Sir-i-kol. A river flows past Yarkand, formed by the junction of two streams, one of which comes from the Terek pass, on the road to Kokand; the other from a lake on the high plain of Pamir, situated between the Terek pass and Sir-i-kol. Ushi is situated among the hills at the base of the Thian-shan, in 41° 3′ N. lat. and 78° E. long.; Khotan, at the base of the high land of Tibet, about 37° N. lat. and 80° E. long. The rivers of Yarkand and Kashgar unite about 40° N. lat. and 80° E. long., and receive near their junction rivers from Ushi and Khotan. The united stream flows eastward to the Lop-Nor (41° N. lat., 89° E. long.), receiving on the way affluents on its north bank from Kutché (41° 37′ N. lat., 82° 50′ E long.), and from Kharashar (42° 10′ N. lat., 87° 10′ E. long.). Almost all that is known of the structure of this region is inference from the direction of its watercourses. The river formed by the union of the rivers of Khotan, Yarkand, Kashgar, and Ushi, flows close to the hills at the base of Thian-shan. East of Khotan the country is represented as a sand-waste, and the same account is given of the country east of Lop-Nor. It would appear from these statements that the river flows in a comparatively deep valley between the mountain-range of Thian-shan and an extension to the south-west of the high desert plain of the Gobi. The accounts of the Jesuits appear to imply that the country between Lop-Nor and the upper Hoang-ho attains to a considerable elevation.

A region of the earth's surface which extends from 52° to 89° E. long., and from near 36° to 55° N. lat., and which varies from an elevation of more than 18,000 feet above the level of the sea to about 82 feet below it, must necessarily present a great variety of climate and geological structure, and, in consequence of that variety, an equal diversity of vegetable and animal life. So small a portion of this region has however been hitherto accessible to scientific research, and the investigations of the few scientific travellers who have visited it have been distracted by so many impediments, that our information on these points is meagre in the extreme.

The passes of the great mountain-range south of Turkistan appear to have generally a slaty structure. On the upper Kokcha, Wood found unstratified black and white limestone, in which is a deposit of lapis-lazuli. Lower down the stream the rock was highly ferruginous, and in some places consisting solely of an iron-ore; and still farther down thick masses of conglomerate rested on thin horizontal strata of sandstone. On the Amu, rather to the west of north from where these rocks were observed, are the ruby-mines; the description of the natives led Wood to infer that the rubies occur either in a limestone rock or in a red sandstone with a magnesian cement. Eastward of these points we only know from the report of Mir Izzet Ullah that there are deposits of oriental jade north of the Karakorum pass. The rocks on the Khulm river, and generally behind Balkh, are sandstone and limestone. The hills which Burnes saw at a distance from Kurshi resembled in outline a trap formation, from which it must not be inferred that they are trap. At the western termination of the mountain-range north of Bokhara, the prevailing rocks are hornblende, siliceous schist, and greenstone. A bad kind of turquoises is found in this range to the west. Mir Izzet Ullah, on his route from Kashgar to Kokand, found that coal was sufficiently abundant to be used by the natives as fuel. The hills which separate the oasis of Bokhara on the north from the sandy tract south of the Sir-deria are greenstone. In the high land described above as south of the Irtish and parallel to its course, greenstone appears to be the prevailing rock; but isolated hills of granite, generally red, are frequent. Immense quantities of gypsum occur east of the Turgai. Rich deposits of copper, lead, and precious stones called by some copper-emeralds, occur at the west termination of this high land. The prevailing rock at Mount Airuk is greenstone; occasionally a kind of brown puddingstone impregnated with iron appears. Towards the upper Ural, red sandstone, lying on the Ilek, and in some other places, under beds of marl, predominates. The prevailing stone from Mount Airuk to the north bank of the Sir-deria and to the termination of the Ust-urt is a calcareous tuff. The immense plain between the Pamir and the Elborz, that to the east of lake Aral between the termination of Pamir and the high land south of the Irtish, that which lies south of the Russian frontier from the source of the Ural to the Irtish, and communicates with the plain east of the Aral by the depression between the Ural and the high land south of the Irtish, have all a surface alternating from clay to sand. The Kirghiz steppes abound with salt lakes, and the greater part of them is covered with deposits of muriate or sulphate of soda. A large subterranean deposit of salt occurs in the valley of the Ilek. There are numerous salt lakes on the west bank of the lower Ural, of which the Indersko lake, nearly opposite to Kalmukova, is the most celebrated.

The thermometer (Fahr.) ranged at Jerm on the upper Kokcha, in the month of January, 1838, from 48° to 10°. The line of perpetual snow in the neighbourhood of Sir-i-kol appears to be above 17,000 feet. In Wakhan on the Amu (8000 to 10,000 feet above the sea) the seed-time is in April, the harvest in July. During winter and spring a strong wind blows steadily down the valley from the north-east, which is unfavourable to vegetation. On the 6th of April, 1838, not a leaf of the mulberry-trees was open at Khulm; the plum-trees had blossomed at Kunduz a month earlier. The harvest at Balkh is fifty days later than at Peshawur, and it is a fortnight later at Bokhara than at Balkh. Between Balkh and Bokhara, Burnes observed (17th to 27th June, 1831) that the thermometer rose to 103° in the day and fell to 60° at night. Meyendorf mentions that the fruit-trees begin to blossom at Bokhara about the middle of February; that there are heavy rains in March; that the summer heat is overwhelming; that there are two or three weeks of heavy rains in October; that in January the ice is sometimes three or four inches in thickness, and the snow sometimes lies fifteen days. The prevailing wind during the whole time he remained in the valley of the Oxus was from the north. Between Astrabad and a point in the desert 200 miles to the north, Conolly found the thermometer range (April 26 to May 19) from 76° to 80° in the shade at noon. He was informed that the communication between Khiva and the Caspian was interrupted in summer by the great heats. Snow lies on the Ust-Urt in the winter; the Aral is frozen so that the Kirghiz can pass on the ice from the mouths of the Sir-deria to the mouths of the Amu. The Amu too is sometimes frozen as high up as Charjui (west of Bokhara), so that caravans can cross on the ice. Along the Russian frontier the weather is more inclement than the latitude and elevation of the country would lead one to expect. The most violent storms come from the north-west.

Between Kunduz and Sir-i-kol, at an elevation of from 8000 to 10,000 feet above the sea, a kind of dwarf fir occurs in the valleys. The same dwarf fir appears to have been seen by Mir Izzet Ullah, between Kashgar and Kokand. From 10,000 to 12,000 feet the red willow and white poplar are met with. Fruit-bearing trees of the plum genus are found at Langer Kish, 10,800 feet above the sea. Above 12,000 feet the red willow alone occurs, but that hardy plant flourishes as high up as Sir-i-kol. Groves of tolerably-sized firs occur in the ravines of the Khulm river, south of Kunduz; but there are no timber-trees on the Hindu Kush. The asafœtida plant and the furze of Tartary are the characteristic plants of the mountains south of Balkh. The grass on the pastures around the Sir-i-kol, and on the high lands west of that lake and south of the Amu, is in general very luxuriant. A little wheat is raised in Wakhan. Large quantities of wheat and other grains are reared round Hazret Imam and Kunduz; and apricots, plums, and other fruits in great abundance and of excellent quality at Kunduz, Kulm, and Balkh. The almond and pistachio nut are natives of the secondary ranges on the north face of the Hindu Kush. The great plain on both sides of the Amu is in most places a barren waste, or thinly covered with straggling furze. Wherever there is water, however, its clay soil is easily rendered fertile by irrigation. In the oases of Khulm, Balkh, Serrukhs, Merve, Kurshi, Bokhara, and Khiva, and on the banks of the Gurgan, most kinds of fruit, vegetables, and grain are brought to perfection. The traces of antient culture in the delta of the Sir, and on the banks of the Turgai, Nura, and Ishim, show that they too must have been fertile when inhabited by a settled and industrious race. The mouths of the rivers which fall into the Caspian and Aral, and the borders of the salt lakes in the Kirghiz steppe, which receive considerable rivers, are choked up with gigantic reeds and other aquatic plants. The characteristic plant of these steppes is the sachsaul. It is found north of the Mongojar range, but stunted and in small quantities. It abounds on the Ust-urt and in the delta of the Sir-devia. In the sands it is a shrub, in clayey soils it assumes the appearance of a tree. It is a dry desert plant, but invaluable to the wanderers of the steppe on account of the slowness with which it consumes, and the length of time which it remains burning. On the upper Ishim there is a considerable extent of forest land.

The most important animal on the highlands of Pamir is the yak, or kash-gow, a diminutive species of the ox. It is to the inhabitants of Tibet and Pamir what the rein-deer is to the Laplander. The gigantic argali, or mountain-sheep, and the markhor, a large species of goat, are also abundant in the high regions. The only other quadrupeds met by Lieutenant Wood at the sources of the Amu were wolves, foxes, and hares. He saw only one bird there, 'a fine black eagle, which came sailing over the mountain, flapping his wings as if they were too heavy for his body.' Eagles are numerous among the inferior ranges; large flocks of the hooded crow frequent the hills in summer, and come down to the plains about Kunduz in winter. The house-sparrows are numerous in Kunduz and Talikhan. Large flocks of partridges are found on the plains of the Amu and among the mountains at least as high as Jerm. Deer frequent the jungle on the river about Hazrat Imam, and antelopes roam in large flocks over the plain of the Amu. The pheasant appears to be indigenous in these regions. In the northern parts of the Kirghiz steppe, the saiga, a kind of antelope, is the most remarkable animal; a species of small eagle, called berkut, which is trained for the chase and much esteemed, frequents the north-west region. The steppe would seem to be the native country of the muridæ, which are found there in almost every possible variety. The wild-bear inhabits the reedy margins of the lakes and rivers; and a tiger, supposed to be the same as that of Bengal, frequents the delta of the Sir-deria. The amphibia of the steppes are characterised by dry, warty, and sometimes almost thorny skins, by large heads and bellies. The Upper Turgai swarms with snakes, many of them of a white colour. There is an astonishing quantity of water-snakes in the lower delta of the Ural. The naturalist to Meyendorf's expedition found a small species of boa on the road between Orenburg and Bokhara.

In Turkistan, the predominant race, as its name implies, is the Turk. The Kirghiz, properly so called, inhabit the high table-land of Pamir and its bordering mountains and valleys. They are nomades, and have a bad reputation even in that region for their thieving propensities. They are a people of low stature, with Mongolian countenances, though speaking a Turkish dialect, which differs little from that of the Uzbeks of Kunduz. The tribes called Kirghiz by the Russians, who roam the steppes from the north declivity of Pamir and southern shore of the Aral to the Russian frontier, and from the Caspian to the Chinese frontier, are divided into the three great hordes. That which ranges the country on the south-east acknowledges the designation Kirghiz, and appears to resemble in most respects the highlanders of Pamir. The horde on the Siberian frontier and that which roams from the Ural range to the Ust-urt affect the name of Kassak (Cossack). The men of the Middle Horde have less of the Mongolian features than the Kirghiz, and those of the Little Horde, as it is called, still less. The Turkoman tribes range the deserts around the Amu and Caspian, from the Ust-urt to the frontiers of Persia and Balkh: these tribes appear, from their lineaments as well as from their language, to be more free from any mixture of Mongol blood than those previously mentioned. The Turkish clans possessed of political power in Khiva, Bokhara, Kunduz, and Kokand are called Uzbeks: in their lineaments they bear a considerable resemblance to the Kirghiz, differing from them mainly in those peculiarities which distinguish a people long civilised from one which has scarcely emerged from savage life. A number of tribes of alien lineage and language live intermingled with the Turkish clans. The Afghans, Jews, Hindus, and other colonists, present no uncommon feature in Asiatic society. But the Persian Tajiks, or agricultural settlers, and the Sartis, or mercantile classes of the same race, who preponderate in Bokhara and some other towns, are remarkable as vestiges of an earlier population which possessed the country previous to the arrival of the Turks. In the cities west of Pamir these Persian tribes are said so to preponderate in number, that their Turkish masters have come to use their language. In the cities east of Pamir on the other hand, the Turkish population would appear to preponderate. The race which, under the name of Siah-push-Kaffirs, has engaged so much of the attention of travellers in Afghanistan, appear to occupy several of the valleys north and south of the Upper Amu. Their language, from the scanty vocabularies that have been collected, affords no corroboration to their claims of a Grecian origin; and their blue eyes and their local position point to the inference that they may be relics of the race called Usiun (and sometimes 'the white race') by the early Chinese historians. The predominant religion among all these tribes is the Mohammedan; but some of the hill Kirghiz are said still to adhere to Shamanism; and Lieutenant Wood, on his journey to the Sir-i-kol, observed many curious traces of lingering impressions from the creed of the Guebres.

The political divisions of Turkistan are:—1, the steppe of the Kassaks and Kirghiz; 2, the plain of the Turcomans, between the Amu and the Caspian; 3, the territory subject to the khan of Khiva; 4, the territory subject to the mir of Bokhara; 5, the territory subject to the khan of Kokhand; 6, the territory subject to the mir of Kunduz: and 7, the territory west of Pamir, incorporated into the Chinese empire.

1. Levchin estimates the population of the Kirghiz and Kassaks at 400,000 tents or families: of these 75,000 belong to the Great Horde: they encamp on the rivers Sara-su and Tshui, on the middle course of the Sir-deria, and around the lakes on the west side of the Chinese province of Songaria. The Middle Horde numbers 165,000 tents: its families encamp on the streams and lakes north of the sources of the Turgai and Sara-su. The tents of the Little Horde amount to 160,000, which are scattered over the delta of the Sir-deria and the country west of the Turgai, between the Russian frontier and the southern termination of the Ust-urt. The auls, or groups of tents, among all these hordes, are held together merely by the ties of a closer relationship. Two classes are recognised by the Kirghiz and Kassaks, the white and the black Kost (or race): the former comprehends the nobles, the latter the lower orders.

The nobles exercise a slight degree of personal influence in their respective auls; and this, and occasional unions of several auls, during a longer or shorter period, for the attainment of a common object, are the only traces of political organization among the hordes, except along the Chinese and Russian frontiers, where an uncertain deference is paid to the injunctions of these governments. 2. The Turcomans are in pretty much the same state of political organization as the Kassaks. Their numbers have been variously estimated, some carrying them as high as 366,000 families or tents; but this estimate includes a number of tribes subjected by the khans of Khiva. 3. The sway of the khan of Khiva extends as far south as a station on the Murgab, twelve miles above Merve; and the Turcomans of Sherrukhs, on the road to Meshed, are in some measure dependent on him. On the west his authority appears to be acknowledged as far as the Caspian. To the north and east his direct power does not appear to pass the delta of the Amu; but his roving predatory bands are met with at no great distance from the Russian station at Mangishlak, in the country of the Little Horde, and on the road east of the Amu which leads from Bokhara to the Russian frontier. The Uzbeks are the dominant tribe at Khiva: Mohammed Rahim, their present ruler, appears to hold the sceptre less in virtue of hereditary respect for his family than of his personal energy. He encourages agriculture within his possessions and trade to them: the predatory excursions which he encourages are either directed against those who have no commercial relations with his country, or, as was the case in his last quarrel with Russia, to prevent merchants seeking a new route which would lead them past Khiva. The population of Khiva proper is estimated at 300,000 inhabitants, but the tribes reduced to a more or less perfect degree of submission must be much more numerous. 4. The territories of the mir of Bokhara reach on the north to the hilly range which extends from the mountains south of Kokand to the Amu; on the east they appear to terminate between Samarcand and Urutuppa, the frontier station of Kokand; to the south and west they include the oases of Kurshi, Balkh, and the town of Charjui, on the west bank of the Amu. The government of Bokhara is at present the oldest recognised sovereignty in Turkistan, and the only one which owes its authority to an hereditary sentiment of respect, independent of the personal character of the ruler. In Khiva, Kokand, and Kunduz it is the khan or mir who governs: in Bokhara it is the law. The organization of the central government differs in no material particular from that which exists in other countries of Islam. Meyendorf estimated the population of Bokhara at the time of his visit as 2,478,000: since that period several districts have been wrested from it by the khans of Khiva and Kokand, in compensation for which it has conquered Balkh. The present population may be about two millions. The government of Bokhara has a standing army of about 25,000 men, most of whom are dispersed in garrisons along the frontier. 5. Kokand in its present extent is a new state, composed in a great measure of successive conquests by its present ruler. Kokand extends on the north to within 45 miles of the south bank of the Tshui: its most western station is Urutuppah, formerly a frontier town of Bokhara: on the east it is bounded by the Chinese frontier; and on the south all the wandering Kirghiz of the Pamir profess to be subjects of the khan of Kokand. The government of this state much resembles in its character that of Khiva: it is however less favourably situated for participating in the gains of the Turcoman and Kirghiz slave-trade and for levying blackmail on caravans, and therefore less heard of. 6. Chinese Turkistan has, since the suppression of the revolt of the Khojas in 1760, been completely organized as a Chinese province, under the designation of the Country of the New Frontier. Chinese garrisons are placed in all the towns along the base of the Thian-shan, in Kashgar, and Yarkand, and lines of pickets keep up the communication between these principal stations. Double rows of custom-houses are placed along the frontier of the province to examine strangers and act as a check upon each other. The administration of justice and the exercise of the local police is left to the Uzbek authorities: the general military and civil authority is vested in Chinese or Mantchu officers. The public revenue is employed to defray the expenses of the provincial administration, and any surplus is sent to Ili. 7. The mir of Kunduz exercises an authority much of the same kind as that exercised by the khans of Khiva and Kokand. His dominions extend on the west to a station nearly midway between Khulm and Balkh; on the south to Sykan, north of Bamian, and farther west to the crest of Hindu-kush; on the east to the Chinese frontier. North of the Amu he exercises a precarious authority over all the settlers who are so unfortunate as to live within reach of his chupaos, or predatory incursions. The forces of Murad Beg, the chief of Kunduz, consist chiefly of cavalry: he can bring together on a surprisingly short warning 15,000 horsemen inured to predatory warfare. He has razed every hill-fort in his country: the fastnesses on the plain are held, with one exception, by members of his own family. Within his own territories he is strict and impartial in the exercise of justice, and subjugated tribes are on the whole leniently dealt with. Besides these states, there are at least four towns, with their adjoining territory, in Turkistan, which may be considered independent of any external government—Maimanu, Andkho, Shibbergan, and Sir-i-pul. They are all situated in oases formed by streams from the Hazareh Mountains, south of the plain of the Oxus. The chief of Maimanu can raise 6000 horse among his Turkoman adherents; the chief of Sir-i-pul can raise 1000 Uzbeks; the chiefs of Andkho and Shibbergan 500 each. The chief of Andkho is an Afshar Turk; the rest are Uzbeks.

Turkistan is formed by nature to be the scene of a transit commerce between the countries which surround it on all sides, rather than of a trade in its own productions. Balkh, Bokhara, and Kokand produce silk and cotton; the Pamir and Hindu-kush supply furs, all the oases large quantities of fruit and grain; metals are raised and smelted in various localities; the steppes supply beasts of burden and for food; and at Kokand and Bokhara silk and cotton stuffs are manufactured. The industry and productiveness of Chinese Turkistan appear to be not less than those of the western region, though the information respecting them is more vague. Still the prosperity of the habitable parts of Turkistan has from the beginning been mainly dependent on its transit trade. The traces of former cultivation which abound in so many places, are proofs of the extent to which this transit trade was once carried. The present lawless and unsettled state of the greater part of Turkistan is the consequence of the decline of this trade, not its cause. These now deserted sites continued to flourish in the times of Tamerlan and Tshinghis-khan (Gengis Khan); they have become waste and desolate since the discovery of the route by sea from Europe to India and China. There is however still a considerable trade carried on in these regions, which is increasing with the extension and consolidation of the great empires of Russia and British India. Bokhara, the seat of the oldest and best consolidated government in Turkistan, is the principal centre of this commerce. This is in part owing to its position, in part to the favourable treatment of merchants: the duties exacted upon goods entering Bokhara only amount to forty per cent.; in Kabul they are fifty, and in all surrounding states higher. Hence the shawls of Kashmir sent to Persia and Turkey pass to Meshed by the route of Bokhara, to avoid the extravagant duties levied on them in the more direct way by Kandahar and Herat. The Lohani traders pass annually from Bokhara to the Indus by the way of Kabul in the month of November, and return by the same route in the month of May. The bankers of Shikarpor, the great money-agents of Central and Western Asia, have branches at Bokhara and at Astrakhan. Many natives of Bokhara have become naturalized subjects of Russia, in order to transact the business of their townsmen in that country with more advantage. According to Meyendorf, nine-tenths of the sales and purchases effected by the merchants of Bokhara in Russia are transacted at the fair of Nishnei-Novgorod, the rest at the trading towns along the frontier. The caravans from Bokhara to Russia proceed by way of Khiva to the Lower Ural. An attempt to introduce the practice of travelling direct by the east of Lake Aral to Orenburg occasioned such hostile demonstrations from the khan of Khiva as led to the abandonment of the scheme. The trade between Bokhara and Russia is more extensive and valuable than that from the south of Hindu-Kush. Next in importance to the trade with Russia is that carried on with Kashgar. A caravan is annually dispatched by way of Kokand to that city, and here the interchange of commodities with the Chinese is effected. A branch of this trade goes up the valley of the Upper Oxus to Kashgar. A portion of the goods received from the Indus, from China, and from Russia is forwarded to Persia by the way of Meshed. Not the least important part of the commerce which finds its way through Khiva is that of Bokhara, which, as mentioned above, is compelled to take that route. Khiva has however a commerce of its own with the Turkomans of the Caspian, with Astrabad, and by way of Merve with Meshed. Kokand is an entrepôt of the trade between Bokhara and Kashgar, but it is also visited by caravans from Petropalovsk, Semipolatinsk, and Ust-kamenogorsk on the Russian frontier. Kunduz has little trade: it lies off the direct line of commerce from Bokhara to the Indus, and the difficulty of the road across the high land of Pamir makes merchants prefer the northern pass of Terek in travelling between East and West Turkistan. Kashgar and Yarkand, lying at the intersection of the great lines of traffic which connect Russia with Tibet and Kashmir, and China with West Turkistan and Tibet, and being moreover situated in productive countries, are the centres of an active and lucrative trade. Even the Kirghiz and Kassaks of the northern steppes of Turkistan have a commerce not altogether to be despised. Levchin says, with singular modesty for a Russian, 'They are in their commercial dealings with Russia for that country what the Russians themselves are for France and England.' It is entirely a barter trade. The Kirghiz and Kassaks exchange camels, oxen, horses, sheep, goats, wool, hides, horns, and furs, for manufactured goods, grain, and flour. Their principal dealings are with the Russians and Chinese; with the former at Uralsk, Orenburg, Troitzk, Omsk, Semipolatinsk, Ust-Kamenogorsk, and some intermediate frontier forts, from the middle of June to the beginning of November; with the latter at Ili and Tshugutshak or Tarbagatai. They also visit Khiva, Bokhara, Kokand, and Tashkend to exchange their raw material for grain and clothing; and passing caravans keep up a petty traffic with the tribes they meet in crossing the desert, while more adventurous traders make the desert itself the scene of their speculations. The statements of the amount and value of the goods exchanged in Turkistan in the course of a year are vague and conjectural; the centres of commercial activity and the lines of traffic can alone be indicated. But it is evidently a busy and increasing trade; will increase with the prosperity and stability of the institutions of Russia, China, British India, and (what is less to be hoped for) Persia; and will be the cause, not the consequence, of introducing peace and the ascendency of law into Turkistan.

The history of Turkistan may be briefly told: it is not unimportant or uninteresting, but materials are wanting. The first distant approach to a steady light thrown upon it is in Arrian's history of Alexander's expedition. The conqueror crossed Western Turkistan from the western termination of the Hindu-kush by the sites of Balkh, Kurshi, and Samarcand, to the south-west curve of the Sir-deria, and appears to have found the region at least as populous and wealthy as at present, and occupied by a number of petty states virtually independent. After the death of Alexander the Grecian dynasty of Bactria appears to have ruled the country as far north as the Aral till about 120 years before the commencement of the Christian æra. [Bactria.] The Greek power north of Hindu-kush was then subverted by invaders from the East, to whom the convenient and unmeaning name of Scythians has been given. Whatever they were, the Parthian kings appear to have succeeded in overthrowing their empire about the time of the birth of our Saviour. The religion of the fire-worshippers, if not previously predominant in these countries, must under the auspices of the Parthian kings have struck deep roots throughout the whole region now called Turkistan; for even at this day traces of it are everywhere to be met with. The early historians of the Chinese remark that upon reaching the country around Lop-Nor the Mongol tribes are succeeded by a race with long or 'horse-like' faces. There was, about two centuries before our æra, the frontier of the Turk tribes to the south-east; on the north-east they appear to have extended to the Upper Kerlon. It is impossible to say whether Turkish tribes took any part in the overthrow of the Greek dynasty in Bactria, but Mohammedan tradition would lead to the conclusion that the hereditary strife between Iran and Turan dates from beyond the Hijra. The Lop-Nor continues till the present day the south-east frontier of the Turkish race. Northward they were obliged at an early period in the Christian æra to give place to the Mongols. In 569 the ambassadors of the younger Justinian found the most powerful of the Turkish tribes seated around the Altai, and Turkish hordes had pushed their encampments as far west as the Caspian. When the Caliphs succeeded to the Persian throne, they found the frontier of Iran extending beyond Samarcand, and for a time they kept it there. The conquests of the Mongol chiefs who overthrew the Caliphate broke down this frontier, and opened the way to successive incursions of nomade hordes from the East. The first princes who inherited the power of Tshingis-khan were Mongols; but the Turkish tribes would appear to have predominated in their armies. At least it is only upon such an assumption that the fact can be explained of all the invaders from the east who permanently settled in Western Siberia along the banks of the Volga, along the north shore of the Black Sea as far as the Danube, in Asia Minor and Armenia, and modern Turkistan, being either pure Turks or a mixture of Turks and Mongols speaking a Turkish dialect. All the Turkish tribes who have played a conspicuous part in history embraced at an early period the Mohammedan religion; their dialects have in consequence been more or less modified by an admixture of Persian and Arabic, and their historical traditions are those common to all Moslems. Of the tribes in Turkistan, the Kassaks, who occupy the north-western steppes, are probably the oldest settlers. The Little and Middle Hordes may be, for aught that appears to the contrary, the descendants of those who wandered in the same regions in the sixth century. The Great Horde, the mountain Kirghiz, and the Turks of Chinese Turkistan received about a hundred years ago a reinforcement from the Siberian Turks, who submitted to Russia in 1606, emigrated from its territories in the beginning of the eighteenth century, and settled among their independent brethren to the south. The origin of the name Turkoman is difficult to ascertain. The Turkomans are the Turkish tribes who in the eleventh and twelfth centuries crossed the Amu and invaded Persia; the name is common to those who still inhabit Turkistan with many tribes in Persia and the Ottoman empire. The traditions of the Osmanli dynasty lend probability to the boast of the Turkomans of the Caspian desert, that the sultans of Constantinople are descendants of their ancestors. The Uzbeks are a mixture of the descendants of the Uigur and Naiman, Turkish tribes who originally inhabited the country from the north-east of Lop Nor to Kashgar, and from Ushi to Khotan, and who figure in the annals of China. They crossed the Sir-deria in the beginning of the sixteenth century, and spread terror and desolation wherever they came. They are at present masters in Kunduz, Kokand, Bokhara, Khiva, and the oases to the west of Balkh. In the seats of an antient civilization such as Bokhara and others, we find the Turks of Turkistan raised to the average level of Mohammedan civilization; the nomade tribes appear to be much in the same state that their ancestors were at the time when history first takes notice of them.

(Moorcroft's *Travels in the Himalayan Provinces*, &c. Burnes' *Journey to Bokhara*; Wood's *Journey to the Sources of the Oxus*; Conolly's *Journey to India*; Fraser's *Journey in Khorasan*; Meyendorf, *Voyage d'Orembourg à Bockhara*; Muraviev, *Voyage à Khiva*; Levchin, *Description des Hordes et des Steppes des Kirghis-Kazaks*; Klaproth's *Asia Polyglotta*; Nazarov and Mir-Izzet Ullah, in Klaproth's *Magasin Asiatique*; Zimmerman, *Memoir on the Countries about the Caspian and Ural Seas*; Mailla, *Histoire Générale de la Chine*; Humboldt, *Fragmens Asiatiques*; Ledebour, *Reise durch das Altaï Gebirge*; Falk, *Beyträge zur Topographie des Russischen Reichs*; Rytschkow's *Tagebuch seiner Reise in der Kirgaskaisackshen Steppe*, Busching, vol. viii.)

TURKOMANS. [Turkey; Turkistan.]

TURKS. [Turkey.]

TURMERIC ROOT. [Curcuma.]

TURNBULL'S BLUE. *Ferricyanide of Iron.*—Professor Graham's account of this variety of Prussian blue is nearly as follows:—It is formed by adding ferricyanide of potassium (red prussiate of potash) to a protosalt of iron. It results from the substitution of three equivalents of iron for three equivalents of potassium. The same blue precipitate may be obtained by adding to a protosalt of iron a mixture of yellow prussiate of potash, chloride of soda, and hydrochloric acid. The tint of this blue is lighter and more delicate than that of Prussian blue. It is occasionally used by the calico-printer, who mixes it with perchloride of tin, and prints the mixture, which is in a great measure soluble, upon Turkey red cloth, *raising* the blue colour afterwards by passing the cloth through a solution of chloride of lime, containing an excess of lime. The chief object of this operation is to discharge the red and produce white patterns, where tartaric acid is printed upon the cloth, but it has also the effect incidentally of precipitating the blue pigment and peroxide of tin together on the cloth, by neutralising the chlorine of the perchloride of tin. This blue is believed to resist the action of alkalis longer than ordinary Prussian blue.

TURNE'BUS, ADRIAN, one of the most celebrated French scholars of the sixteenth century. His French name was Tournebœuf, and some writers, as Dempster and Mackenzie, have maintained that this is only a French translation of the English name Turnbull, and that Turnebus was the son of a Scotchman who had settled in Normandy. The common account however is that he was born in 1512, at Les Andelys in Normandy, and in his eleventh year he was sent to Paris to be educated. His uncommon talents, combined with his indefatigable diligence, soon raised him above all his fellow-students, and he is said on many occasions to have shown more knowledge than his masters. After the completion of his studies he was for some time engaged in teaching the antient languages at Toulouse, until in 1547 he was appointed professor of Greek at Paris, whither his name and that of A. Muretus attracted students from all parts of Europe. In 1552 he undertook in conjunction with William Morel the management of the Royal Printing Establishment of Paris for Greek books, but after the lapse of three years he resigned this office for that of Royal Professor. Notwithstanding the many brilliant offers that were made to him in several foreign countries, he remained at Paris until his death, on the 12th of June, 1565.

Seldom has a scholar in his lifetime enjoyed such a universal and truly European reputation as Turnebus. He was a man of a diffident, modest, and very amiable character, and no one who knew him could help becoming attached to him. Henry Stephens is reported to have said: 'Turnebus pleases everybody because he does not please himself.' In his learned controversies however with Ramus and Bodinius, he is sometimes as severe as he was naturally gentle. As a scholar he was not inferior to any of his contemporaries: even on the day of his marriage he could not abstain from devoting a few hours to his studies. His works consist of philological dissertations, some of which are polemical, critical commentaries on various antient authors, and translations of Greek writers into Latin. His criticisms are generally masterly, but, like most great critics, he was too fond of making conjectural emendations. His Latin translations are among the most elegant and correct that have been made. His Greek translation of Cicero's essay 'De Fato' is a proof of his thorough knowledge of the Greek language. Most of his works, all of which appeared separately and at different times, were collected and published after his death by his second son, Stephen Turnebus, under the title, 'Adriani Turnebi Opera,' Strassburg, 1600, 3 vols. fol. Besides the works contained in this collection, he wrote several others, the best of which are his 'Adversaria,' consisting of 3 vols. 4to., the third of which was edited after his death by his son Adrian Turnebus. The first edition of the first two volumes appeared at Paris in 1564. It was several times reprinted, but the best edition is that of 1599, fol.

(Nicéron, *Mémoires*, vol. 39; Teissier, *Eloges des Savans;* compare Mackenzie, *Scotch Writers;* Saxius, *Onomast.*)

TURNER, WILLIAM, a physician, naturalist, and divine, was born at Morpeth in Northumberland, about the year 1520. He studied at Cambridge, and having taken a very decided part in the great religious questions that were discussed, he made himself obnoxious to the dominant party, and was thrown into prison. After his release from prison he resided on the Continent till the death of Henry VIII., when he returned to his own country. His studies at Cambridge had been more particularly directed to physic and divinity, but on the Continent he became acquainted with Conrad Gesner at Zürich and Luc Ghini at Bologna, and acquired a taste for natural history. During the reign of Edward VI. he was made physician to the protector Somerset, and was afterwards made a prebendary of York, dean of Wells, and a canon of Windsor. He was however again obliged to fly to the Continent on the accession of Mary, where he remained till the reign of Elizabeth, when he again returned, and was presented with all his original benefices.

Turner is said to have published several works on botany, but his greatest work on this subject, and that on which his reputation as a botanist rests, is his 'Herball,' the first book of which was published in black letter, small folio, with wood cuts, in London, in 1551. A second book was published at Cologne in 1562, and the whole work was republished at the same place in 1568. This work is arranged alphabetically, and contains much laborious research and acute criticism with regard to the plants then known. Although he appears to have collected plants himself, he has described but few new ones in this work. The medical properties of the plants are treated of, especially those which were unknown to the antients. Subjoined to this book is one on baths, in which the author speaks of the properties of various medicinal springs in England, Germany, and Italy. His other writings connected with medicine were, a work on the wines used in England, and another on the properties of treacle. In 1544 Dr. Turner published at Cologne a small octavo volume on the birds made mention of by Pliny and Aristotle, entitled 'Avium præcipuarum, quarum apud Plinium et Aristotelem mentio est, Historia.' In Gesner's great work, the 'Historia Animalium,' there is an account of the British fishes by Dr. Turner. These works afford abundant evidence of his powers as a sound critic and accurate observer in the science of zoology.

Dr. Turner published several works on controversial divinity; also a collation of the translation of the Bible into English, with the Hebrew, Greek, and Latin copies. He also translated several works on science and divinity from the Latin into English.

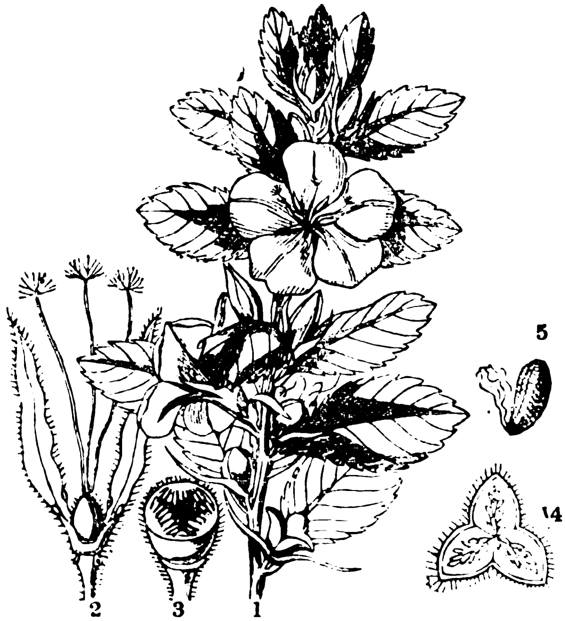
His fondness for plants led him to their cultivation, and he had botanic gardens at Wells and Kew. He died July 7, 1568, leaving a large family. Turner was one of the earliest pioneers of natural science in Great Britain, and had it not been for the stormy period in which he lived, and the shortness of his life, he evidently possessed a genius that could have placed its possessor foremost in the ranks of the cultivators of natural history.

TURNER, SAMUEL, author of 'An Account of an Embassy to Tibet,' was a native of Gloucestershire, and born about the year 1759. Having entered the service of the East India Company, he gained the confidence of Warren Hastings, and was sent by him on a congratulatory mission to the new Dalai Lama in 1783. In 1792 Turner distinguished himself at the siege of Seringapatam, and was subsequently sent ambassador to the sultan of Mysore. He returned to England soon afterwards with a large fortune. He was seized with apoplexy on the night of the 21st of December, 1801, in an obscure street in London, and, having no papers about him to intimate his name or place of abode, was carried to the workhouse in Holborn. When discovered by his friends, it was deemed unsafe to remove him, and he died in the workhouse on the 2nd of January, 1802, in his 43rd year. Turner was a Fellow of the Royal Society, and a member of the Asiatic Society of Bengal. Besides the account of his embassy to Tibet, which is still a standard work (published in 1800), he contributed to the 'Transactions' of the Asiatic Society an account of his interview with the Teshoo Lama, and an account of Poorungeer's (a native priest in the employment of the Company) journey to Tibet in 1785, both in vol. i.; and an account of the Yak of Tartary, in vol. iv. The account of his interview with the Teshoo Lama was reprinted as a small pamphlet at Oxford in 1798. The account of the embassy was translated into French by J. Castéra, and into German by M. C. Sprengel.

TURNER'S YELLOW. *Cassel Yellow: Patent Yellow.*—This is an oxichloride of lead, which may be prepared by different processes: when litharge, or the protoxide of lead, is acted upon by a solution of common salt, there are formed soda, which remains dissolved, and a white compound, which is hydrated oxichloride of lead; and this, when heated, loses water, becomes of a yellow colour, and is the compound required. It is composed nearly of one part of chloride and nine parts of oxide of lead: it may also be obtained by heating chloride and oxide of lead together in the requisite proportions, or by heating a mixture of one part of hydrochlorate of ammonia with ten parts of protoxide of lead. In fusing these compounds it is requisite to be extremely careful to avoid any admixture of carbonaceous or combustible matter, as that would reduce a portion of the oxide of lead to its metallic state, which would injure the colour of the product.

TURNERA. [TURNERACEÆ.]

TURNERA'CEÆ, the name of a natural order of plants, belonging to Lindley's parietose group of polypetalous Exogens. It possesses an inferior calyx, often coloured, having 5 equal lobes imbricated in æstivation; 5 petals, which are inserted into the tube of the calyx, equal and twisted in æstivation; 5 stamens, which are also inserted into the calyx below the point of insertion of the petals, with which they alternate with oblong 2-celled anthers; a superior ovary 1-celled with 3 parietal placentæ, indefinite ovules, 3 or 6 styles, which cohere more or less together; a 3-valved capsule, the valves bearing the placentæ in the middle, and opening from about as far as the middle of the capsule; seeds with a reticulated testa and a membranous aril, and a slightly-curved embryo lying in the midst of fleshy albumen, and having the radicle turned towards the hilum. This order has only two genera; all the species are herbaceous plants, in some instances having a tendency to become shrubby. Sometimes the whole plant is covered with pubescence; but it has not, like that of allied orders, any stinging property. The leaves are alternate and simple, without stipules, and occasionally have 2 glands at the apex of the petiole. The petals are generally of a yellow colour, and sometimes blue. The flowers are axillary and solitary. The pedicel is either free or coheres to the petiole; is articulate, and furnished with two bracteæ at its base.



Turnera ulmifolia.

1, cutting, showing axillary solitary flowers; 2, section of flower, with ovary, style, and multifid stigma; 3, section of capsule; 4, valves with parietal placentæ; 5, seed with reticulated testa and aril.

The affinities of this order are with Fourquieraceæ, Cistaceæ, Malvaceæ, Loasaceæ, and Passifloraceæ, especially with the two last. The species of this order are exclusively natives of the West Indies and South America.

The genus *Turnera*, which is the type of the order, was named in honour of Dr. Turner. [TURNER, WILLIAM.] It is known by possessing a calyx tubercularly funnel-shaped; 3 simple styles, which are cleft at the apex into a number of stigmas, and a capsule opening from the apex to the middle. Don, in his edition of Miller's 'Dictionary,' enumerates 49 species of Turnera, all of which are found in South America and the West Indian Islands. One of the species, the *T. trioniflora*, the Ketmia-flowered Turnera, was once stated to have grown in Japan, but this wants confirmation. None of the species are used in medicine or the arts; they are however frequently cultivated in gardens. They are mostly small plants with inconspicuous flowers generally of a yellow colour, and having very much of the habit and character of the species of Cistus. The annual species perfect their seeds in this country, by which means they may be propagated. The seeds should be sown in a hotbed in the spring, and in warm sheltered situations they may be planted out in an open border, when, if the summer is dry and warm, they will blossom, and ripen their seeds. Cuttings will also root freely under a hand-glass.

The genus *Piriqueta*, which was first made by Aublet who has not given the derivation of this word, has a campanulate calyx; 6 single styles or 3 bi-partite ones, with multiplied stigmas. It has pediculate flowers, the pedicels without bracts, and articulated above the middle. There are only two species, the one a native of Guiana, the other on the Orinoco.

TURNERITE, a mineral which occurs in attached crystals. Primary form an oblique rhombic prism. Cleavage parallel to both diagonals of the prism. Fracture conchoidal. Hardness 4·5 to 5·0: readily scratches phosphate of lime. Colour yellow or brownish-yellow. Lustre vitreous. Translucent; transparent. Dissolves almost entirely in hydrochloric acid. Found at Mont-Sorel, département de l'Isère.

It has been examined by Mr. Children, who found it to consist principally of alumina, lime, and magnesia, with a small quantity of iron, and a minute portion of silica.

TURNHOUT is a flourishing manufacturing town in the province of Antwerp, in the kingdom of Belgium, situated in 51° 18′ N. lat. and 4° 58′ E. long. It is about twenty miles east by north from Antwerp, between the heaths of Ravel and Balk. It is a well-built town, and has above 13,000 inhabitants. Its chief manufacture is that of bed-ticking, which, on account of its durability and fineness, is in much esteem in foreign countries. The inhabitants likewise manufacture considerable quantities of linen, calico, and coverlids, and have extensive bleaching-grounds for linen, cotton-yarn, and wax. There are numerous brandy-distilleries in the town. The town was formerly a lordship which was part of the disputed inheritance of king William III. of England; and was adjudged in 1710, by the feudal court of Brabant, to the prince of Nassau, hereditary governor of Friesland; by the convention of 1732 it was assigned to Prussia, and ceded by that power in 1735 to Austria, which erected it into a duchy, and conferred the investiture on the count of Taronca. In the year 1596 Prince Maurice of Nassau, at the head of a detachment, defeated a considerable body of Spaniards near this place; and in 1789 a sanguinary action took place between the Austrians and a body of the Netherlands insurgents, in which the former were defeated.

(Hassel's *Handbuch*; Stein, *Geographisch-Statistisches Lexicon*; Cannabich, *Lehrbuch*.)

TURNING. In all the range of manufactures, whether of articles of necessity, utility, or luxury, there is no operation so general as turning; it is equally applicable in all stages of the work, from the rudest shaping to the highest polish. The lathe by which it is performed has also this quality, that while without it the workman, to produce a regular figure, must labour at all parts with much care and trouble, and in the end only partially succeed, it only requires the profile given, and the requisite figure is produced with the greatest accuracy. The value and principle of the lathe may be summed up in a few words: for every point marked by the workman, it produces a circle; and it may be described as a machine for moving the material to be wrought in such a manner that, being fixed opposite to the tool, any point in the circumference will act upon the whole circle in precisely the same way.

Pole-lathe.—This is the primitive and most simple kind of lathe: it consists of two upright pieces, each having a conical iron or steel point fixed on the side opposite the other, the two points being exactly in a line; one of these uprights, or puppet-heads, as they are called, is stationary; the other can be moved along and fixed at any part of the bed by a wedge beneath: the wood to be turned being cut of the proper length, the centre of one of its ends is pressed against the point of the fixed puppet; the point of the other puppet is then brought against the centre of the other end, and the puppet wedged firmly in its place: over the lathe, and at right angles to it, is a long flexible wooden pole or lath, whence the name 'lathe;' one end, fixed firmly overhead; the other, which must be just over the end of the work nearest to the left-hand puppet, has a cord or catgut attached to it, which passes once or twice round the work, and is fastened at the lower end to a treadle: the depression of the treadle and counteraction of the pole give an alternate rotatory motion to the work. The tool is held upon the top of a fixed piece, between the two puppets and close to the work, called a rest, but can only be applied during the fall of the treadle; and thus a great loss of time is occasioned. On this account the pole lathe is now but little used; it still however may be seen in the shops of some of the Spitalfields bobbin-turners, who work in alder and other soft woods, and require great velocity and an easy motion. When commencing, a groove is cut to the extreme left of the work for the cord to work in; and if it is required to use that part, the band is afterwards shifted to a finished part.

The beginner has one great difficulty to overcome in turning soft wood; the tool requires to be held firmly yet tightly almost on the top of the work, and the superfluous material must be shaved off; while the softness of the wood and the velocity with which it revolves cause the work to be easily spoilt by the least unsteadiness of hand. In other turning the tool is held opposite or nearly opposite to the centre of the work, and the superfluous material is scraped away with very little comparative danger of accident.

A modification of the primitive pole-lathe is used by watch-case makers, on account of the facility with which it can be arrested at any point of its rotation. In the turning of watch-cases it is necessary to work close up to the handle, or pendant; and as the lath or pole has a constant tendency to carry the work back from the tool, the workman, by regulating the pressure of his foot upon the treadle, can do so with the greatest nicety without the danger that attends such work in a lathe with a foot or fly wheel, which has a momentum in the cutting direction.

The middle of the mandril is made thick and formed into a pulley, around which the cord is twice coiled, and then fastened to the treadle, which moves on centres fixed in the back ends of the feet of the lathe frame. The nose of the mandril is tapped with a hollow screw, to receive the chucks upon which the work is fixed.

Some case-makers, the French in particular, make use of a large *turning-tool* instead of a lathe: it consists of an iron bar upon which slide three puppets, two to support the mandril with its back screw, and the other the rest; a long steel bow worked by the left hand serves instead of the pole and treadle. When in use the turning-tool is held in a vice, and can be put out of the way when not wanted: it works easily, costs but little, and where many workmen are employed effects a great saving of room. Tools of this sort, from six inches to two feet long and upwards, are in use among jewellers, goldsmiths, watch and clock makers, and many other artificers; and others without any mandril, in which the work is held between two points, as in the pole-lathe.

One of this latter sort may be converted into a very useful lathe for small work at a trifling expense, and still answer as a turning-tool if required. Take out the cylinder of the puppet to the left hand, which should be movable and fastened by a screw, and upon the end just above the point fit a small brass pulley with three or four grooves, the largest about two inches diameter; drill a hole in the face of the pulley, to take a steel pin about an inch long; fasten a wheel of twelve or eighteen inches diameter at a short distance from the lathe opposite the pulley, and connect it with the latter by means of a catgut band; the wheel may be turned either by hand or by a treadle; a carrier, such as is described afterwards, *Fig.* 6, is to be fastened upon the end of the work, as in *Fig.* 4, and the steel pin in the pulley will carry it round.

The *Potter's wheel* is the simplest description of rotatory lathe, but it differs from other lathes in being vertical instead of horizontal. C, *Fig.* 1, is an iron crank, upon the lower part of which is placed a heavy foot-wheel, F; the lower end of the crank works upon a centre, P, fixed on the floor; the upper in a collar, B, fastened to the work-bench, A, and supports the turnboard or chuck, D, upon which the clay to be worked is placed: motion is given to the crank by means of a treadle placed at the back, and connected with the throw of the crank by a hook or rod. For large work the wheel is provided with a winch and bevil gear, and is turned by a boy. The clay is made up ready for the turner in lumps each sufficient for one vessel; taking one of the lumps, he throws it, with force enough to make it adhere firmly, upon the face of the turnboard, and causing the wheel to revolve very quickly at first, he fashions the clay to the requisite shape almost entirely with his hands. An upright stick or rod, R, is fixed into the bench at a little distance from the edge of the turnboard, and upon it are fixed small pointers or guides to show the required height of the vessel, and the place of any hollow, rim, or moulding. The potter uses but few tools except scrapers to remove any pieces that adhere to the surface in the course of turning, to give the surface of the vessel a close and smooth texture, and fill up pores, and also to mark any small mouldings that cannot be managed by the fingers. When the work is finished, a piece of thin wire is used to separate it from the turnboard.

Fig. 1.

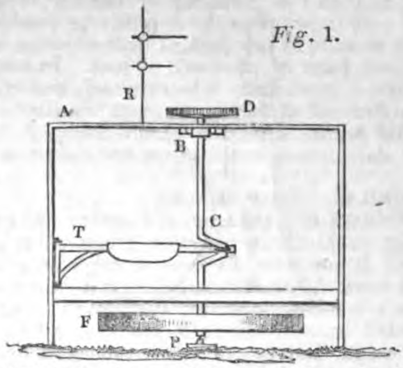
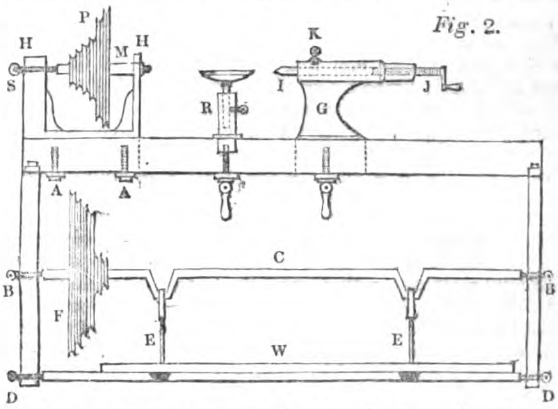
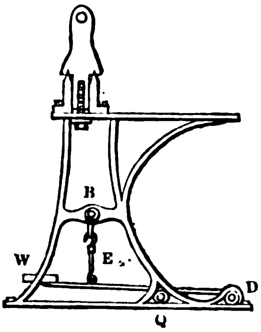


Fig. 2.



Foot-lathe.—*Fig.* 2 is the front-view of a foot-lathe of excellent construction, adapted to all ordinary work, whether in metals, ivory, or wood. The body of the mandril is made of wrought-iron, the point and working-collar of steel: the nose is cut with a coarse screw to carry the chucks. The headstock, H H, is of cast-iron, with a conical steel ring let into the front puppet within which the mandril works. A steel-pointed screw in the back of the headstock keeps the mandril steadily in its place. The beds are of cast-iron, V-shaped, as it is called, shown in the end view, *Fig.* 3, which also shows the manner in which the headstock is fitted upon and between the beds, to which it is firmly fastened by two screws, A A, *Fig.* 2. The crank, C, is of wrought-iron, supported at each end by a screw, B, *Fig.* 2, 3, in the standard of the lathe. The fly or foot wheel, F, has four or five grooves on its edge, and gives motion to the mandril by means of a catgut band, which connects it with the smaller part of the mandril pulley, P. The object of having several grooves upon the wheel and pulley is to allow of the speed of the lathe being regulated according to the sort of work to be turned: these grooves are turned of such diameters that the gut, when in the largest groove of the foot-wheel, fits the smallest on the pulley, and so on with the rest; but this arrangement only modifies what is called the quick motion, and it is frequently necessary that the mandril should move more slowly than the crank, for which purpose a large pulley is placed upon the mandril, and a small one upon the crank, and the two are connected by a band. The ends of the band should be fastened by a hook and eye, which is much more convenient than the splice, and allows one band to be removed and another substituted at pleasure. The treadle is formed of a long iron bar suspended between two points at the back of the frame, D, *Fig.* 2 & 3, and carries two shorter transverse bars at right angles, passing under the throws of the crank, and being connected with them by the hooks, E E: the front ends of these two pieces are screwed to the treading-board, W. The standards of the lathe are prevented from altering their position by a rod passing close to the ground, and screwed to each standard at Q.

Fig. 3.



The front-head, G, is of cast-iron fitted on to the beds in the same manner as the headstock, except that, instead of two screws beneath, it has only one in the centre, with a jointed lever attached, to allow of its being easily shifted and fastened at any part of the beds. The point of the cylinder, I, to support one end of the work, must be exactly opposite to the centre of the mandril. There are several methods of arranging the cylinder and its screw, but the following is the best with which we are acquainted, and obviates the necessity of having two cylinders, one with a conical point, the other with a sunk centre, to suit different work, as is commonly the case. The cylinder is turned with a point at one end and a sunk centre at the other, and accurately fitted by grinding, so that either end may be outwards as required: a gun-metal box is fixed at the back, and tapped to receive the screw J, which is turned by a winch-handle, and presses the cylinder forward against the work. K is a small screw with a binding-piece or saddle beneath, which rests upon a flat filed on one side of the cylinder, and prevents the latter from shaking during turning. The rest, R, has a jointed lever binding screw, like the front-head, and several Ts or tops to suit different purposes, with a small screw to hold them steadily in the socket. This completes the lathe itself, but many adaptations are necessary before it is in order for work: of these the principal are the chucks used to connect the work with the lathe. The *screw-chuck* is a circular plate of metal with a boss at the back, tapped to screw upon the nose of the mandril: the face is turned perfectly true, and in the centre is a coarse conical screw to hold any large piece of wood to be turned; a hole being made in the centre of the work, it is screwed tight up against the face, and no further adjustment required. The *hollow-chuck* is a strong circular cup of metal with perpendicular sides: the work is either driven into it with a mallet, or, if smaller than the inside of the cup, held by the ends of four screws in its rim. The *drill-chuck* is a strong iron chuck about an inch in diameter, with a square hole in the centre to receive drills and other similar tools. In drilling, a mark being made with a punch where the hole is to be, the work is held against the point of the drill, and the front-head being brought up to the back of the work, the cylinder is pressed forward, as the drill proceeds, by turning the screw, J. If the work is to be drilled quite through, a guard is placed upon the cylinder with a hollow in the centre to receive the point of the drill.

The *universal chuck* is a circular disc of metal, as large as the beds of the lathe will admit, with three narrow slits cast in it, extending nearly from the centre to the circumference: the face is turned perfectly true when on the mandril, and the work being laid upon the face of the chuck, is fixed to it by screws which pass through the slits, into nuts at the back of the plate: this is an exceedingly useful chuck, and at the same time simple and cheap.

The *concentric chuck* is of the same form as the last described, and the face in like manner must be turned perfectly true to the mandril upon which it is to be used. Instead of three slits it has but two, in a straight line with each other, and extending nearly the whole diameter; the opening of these slits is wider at the back than front, and they must be filed up with the greatest accuracy, that their sides may be perfectly straight and parallel with each other: within these slits lies a spindle, having a bearing in the centre and one at each extremity, with a right-hand screw upon one end and a corresponding left-hand screw upon the other; these screws move two steel studs which fit accurately within the slits, and have projecting heads about an inch square, that move steadily and smoothly along the face of the chuck: the concentricity of the chuck depends upon these heads being perfectly square and equi-distant from the centre: upon the heads are fitted two other square pieces, having their sides hollowed out in curves of different diameters varying from two to eight or ten inches, and which can be placed with either of their sides towards the centre, to fit the circumference of the work to be held between them.

This is an exceedingly valuable chuck, as the work can be placed in it without the trouble of fitting, is always perfectly concentric, and can be removed and replaced without danger of altering its position; but the most excellent workmanship is required to make it accurately, and it is consequently very expensive.

All the chucks that we have described are adapted principally for work which does not require supporting at both ends, or *turning in air*, as the French call it. When a long piece of wood is to be turned, a chuck is used having a piece of steel with three points standing out upon its face. the centre of one end of the work is pressed against the middle point, and the other end is supported by the cylinder of the front-head.

The *carrier* is used in metal-work for the same purpose as the three-point chuck for wood, and perhaps no contrivance for connecting the work with the mandril is in such constant requisition. If the ends of the work are pointed it is supported between the hollow end of the cylinder in the front puppet (S, *Fig.* 4) and the nose of the mandril, which is similarly shaped for the purpose: if, on the contrary, the ends are hollow, the cylinder is reversed and the point-chuck, *Fig.* 5, screwed upon the mandril. The carrier, C, *Fig.* 4, is fixed upon the end of the work by its screw, as shown on a larger scale in the side view *Fig.* 6, and motion is given to the work by the driver H, *Figs.* 4 and 5, either screwed upon the nose of the mandril or attached to the point-chuck. Like the concentric chuck, the carrier allows the work to be taken out of the lathe and replaced without disarrangement.

Fig. 4.

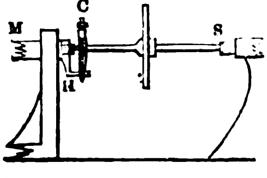


Fig. 5.

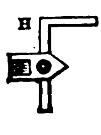
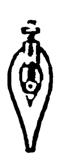
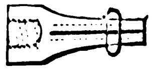


Fig. 6.



Wood and ivory turners make use, principally, of box and other wood chucks altered at the instant to suit their purpose: sometimes an iron ring is used to prevent its splitting. One chuck however requires notice, called the split or *ring-chuck*, *Fig.* 7: a piece of wood is tapped and screwed on to the mandril and then turned conical: it is afterwards drilled down the centre to the bottom, and two slits cut with a saw at right angles to each other, from the point of the chuck to the nose of the mandril; the work, when in the chuck, is held in its place by the ring on the outside. This chuck is very useful for finishing off small tubes, mouth-pieces, or other work which would be split or defaced by being forced into a common chuck, and has besides the advantage of being concentric.

Fig. 7.

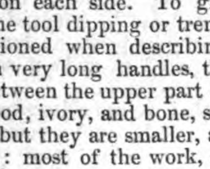


Setting the work true to the lathe in common chucks is very troublesome to young turners: the proper method is to knock the work pretty firmly into the chuck with a mallet or hammer, the left hand pressing against the back of the pulley to prevent the blow injuring the mandril centre, then turn the mandril gently round with the left hand, and tap the work at the most prominent parts until it runs as true as the shape of the material will allow. When greater accuracy is required, as in the case of the wood being but just large enough, or still more when work already turned is to be again put in the lathe, place the rest near the front of the work, hold a piece of chalk opposite the outer edge of the work, turn the lathe gently round, and mark the parts which are prominent: at first it requires considerable care and patience, but after a little practice it becomes exceedingly easy. When the work gets loose in turning, a little chalk rubbed round the inside of the chuck will generally make it hold.

The *tools* used in turning are so various, that a description of them would fill pages, if indeed many of them could be described at all: we shall only mention a few most commonly in use. For soft wood scarcely any are required besides gouges or round chisels with circular points, to rough out the work, varying from a quarter of an inch to an inch and a half wide, and chisels with an oblique cutting edge, sharpened by being ground and rubbed at a very acute angle on each side. To give the workman power to prevent the tool dipping or trembling, the danger of which we mentioned when describing the pole-lathe, the tools are set in very long handles, the ends of which the turner holds between the upper part of his arm and his side. For hard wood, ivory, and bone, similar gouges and chisels are used: but they are smaller, and sharpened at a less acute angle: most of the work, as in gold, silver, and light brass-work, is performed by gravers with straight, oblique, and curved faces, to suit different sorts or parts of the work. These are sharpened by an angle on the under side only, and the cutting-edge is applied nearly opposite to the centre of the work. For inside work, drills placed in handles are used to make the first opening, which is afterwards enlarged by other tools of almost every conceivable shape, according to the form of the work—straight, oblique, double-angular, semicircular, curved, and hollow; but with this general characteristic, that the stalk is made narrower than the cutting part of the tool, to allow of undercutting or making the hollow within larger than the opening through which the point of the tool is introduced. These drills and tools are generally used with a hook held upon the rest in the left hand, in the bend of which the tool is placed: this allows much more freedom for the workman's hand than if the rest were set across the work, and does not exclude the light.

The principal tools used for turning iron are the hook-tool, *Fig.* 8. E is the cutting-edge; the heel, H, is placed firmly upon the top of the rest and the tool held with both hands, the end of the handle resting against the turner's shoulder: this tool is admirably adapted for removing the rough outside crust, as it combines acuteness of edge and strength in an unusual degree. For finishing the work, gravers of different sizes and shapes are used, similar to those for hard wood, gold, silver, brass, and ivory, but stronger and sharpened at a more obtuse angle.

Fig. 8.



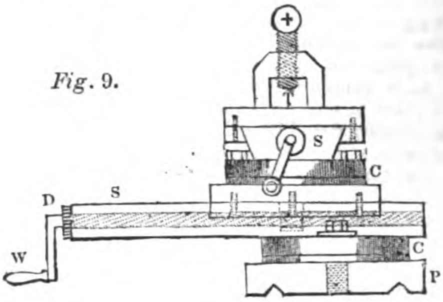
Screw-tools are very important appendages to a lathe, and, with the engineer, in constant use: they are filed up with several teeth exactly the shape of the spaces between the intended threads, and used in the following manner:—the piece of metal being turned to the proper size and shape, the workman holds the tool in his right hand upon the top of the rest; then clasping the rest with his left hand, he places the thumb across the tool, and gives the point a circular motion towards the left as the work revolves: this he repeats until a few threads are cut near the point, which answer as guides for the next, and so on till the screw is complete. The tool must be held firmly, that it does not get out of the thread and so spoil the screw; but the pressure must be light, particularly if the screw is of any length, or it will warp and become untrue. To produce a left-hand screw, the thread must be begun at the upper end, instead of the point. For inside screws the teeth are cut on the side, instead of the front, of the tool: taps however are much more generally used, except where the thread is to be cut to the bottom of a cavity, or the screw is of unusual dimensions. Engineers and others cut screws of all sorts and sizes with extraordinary facility, but to do so requires a steady hand and considerable practice.

A circular saw is often fitted to a lathe, particularly for ivory turning: the saw is placed upon a spindle against a projecting collar, and held in its place by a washer and nut: the spindle is held between the mandril and front puppet, and over it is a small table, with a slit to allow the upper part of the saw to pass through: this table is mounted upon a frame fixed to the beds of the lathe in the same manner as the rest, and can be raised or lowered according to the depth that the saw is wanted to cut. A parallel rule is fitted upon the table by the side of the saw to regulate the width of the pieces cut off. Angular pieces are cut by interposing a piece of wood of the required angle between the work and the rule, and passing them along the latter together: a jointed rule is used for the same purpose, with a screw to fix it at any angle less than a right angle.

In the lathe, as previously described, the tool is held in the hand, and is consequently subject to any unsteadiness in the workman: to get rid of this imperfection in certain cases, and so arrange that the tool could be withdrawn at pleasure and replaced in the same position, and always be steady, was a great desideratum, and it was effected by the invention of the *slide-rest*, which is now attached to all but the most ordinary kind of lathes. The principle of the slide-rest is that the tool is fastened to a plate, moved in the required direction by means of screws, instead of being held in the hand.

There are various modes of construction, but *Fig.* 9 is of very simple, usual, and convenient form. T is the place for the tool, which is held down by the screw above: the tools are long square pieces of steel reaching beyond the edges of the plate upon which they are fixed, and which in common-sized rests is from 4 to 6 inches square. This plate has two small slips or dove-tails screwed on to its under surface and fitting the sides of the plate S, which has a screw along its centre, working in a nut in the upper plate, so that by turning the winch-handle, the end of which is seen at S, the tool can be moved backward or forward along the plate S, which is about twice the length of the upper or tool plate, as seen in the lower slide, also marked S, at a right angle to the upper. Beneath the plate S is a circular piece C, divided by a line into two unequal portions; the upper and thicker portion is screwed to the plate S, the lower is in fact only a circular fillet left upon the plate below: in the centre of the latter is fixed an accurately-turned pin fitting into a corresponding hole in the former, which turns upon it as a centre, and can be set at any required angle to the lower plate (which is graduated for the purpose) and fixed in its position by two binding screws, shown in the figure on each side of S. Beneath are a second slide and circular plate, counterparts of those above, and the whole is mounted on a plate P, which fits on the beds of the latter in the same manner as the simple rest and front puppet, *Fig.* 2.

Fig. 9.



The manner of using the rest will be easily understood. To produce a perfectly flat surface, when the work is fixed upon the mandril, set the lower slide at a right angle with the beds of the lathe and the upper one exactly across it; set the point of the tool to the centre or outside of the work, according to circumstances; set the lathe in motion, turn the winch of the upper slide till the tool cuts deep enough, and then as the lathe revolves draw the tool gradually across the surface by means of the winch of the lower slide; this must be repeated with the hook or other roughing tool till a regular surface is obtained; a graver is then substituted for the roughing tool, and the same movements of the rest are repeated until a smooth surface is produced. In turning cylinders the lower slide must be parallel, and the upper at a right angle to the bed. For cones the lower slide must be set obliquely, according to the angle required. Hollow and spherical surfaces may be cut with the slide-rest with equal accuracy as rectangular figures, either by an adaptation to the common slide-rest, by which the lower slide is made to act upon the other, or by one constructed for the purpose.

The slide-rest is of great value in producing any number of pieces of work of exactly the same form, of opposite forms and fitting each other, or in any given proportions; each slide-screw is fitted with a small circular graduated plate and sometimes also with a micrometer screw and plate, so that the greatest nicety can be observed.

It is however only in conjunction with the power-lathe, so called as being moved by steam or other power not manual, that the full value of the slide-rest is exhibited. The beds, headstock, and slide-rest of the power-lathe, *Fig.* 10, are made in the same manner as in the foot-lathe, but stronger; the mandril works in bearings to allow the end B to project beyond the back puppet and carry a toothed wheel; between the beds and along their whole length is a screw E, which works in a nut attached to the under part of the rest; on the end of the screw is placed another toothed-wheel D, which is turned by the mandril-wheel B by means of the connecting wheel C. By varying the size of the wheels B and D, the rest can be made to move through any required space along the beds of the lathe at each revolution of the mandril. The spindle of the connecting wheel C fits in a curved groove to accommodate it to the different sized wheels used on the mandril and rest-screw; when the rest is required to move in the opposite direction, two connecting wheels are used. The size of these connecting wheels, having no influence on the relative rates of B and D, may be varied according to circumstances.

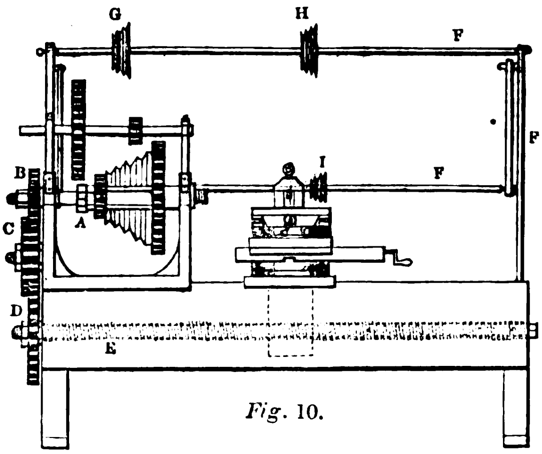


Fig. 10.

It is requisite in turning large heavy work that the lathe should a times move very slowly: this is effected by the spindle and wheels being placed over the mandril. The proper place for the spindle is at the back of and parallel with the mandril, but it is sometimes placed over it, and we have availed ourselves of this fact, that the whole of the machine may be exhibited in a front view. The pulley, instead of being fixed upon the mandril, as in the foot-lathe, is mounted upon a metal tube or cannon which fits and turns smoothly upon the mandril. The large toothed-wheel in front of the pulley is fixed to the mandril, the smaller to the cannon: the nut A runs upon a thread cut on the mandril, and causes the pulley to move with the latter when the lathe is to be driven at the ordinary rate; none of the toothed-wheels are then in action. When a slow motion is required, the nut A is unscrewed and the driving spindle moved forward in its bearings till the four toothed-wheels are engaged; the band then drives the pulley round, independently of the mandril, and the toothed-wheel upon the cannon moves the larger upon the spindle, which gives motion to the mandril by means of the two other toothed-wheels. If the two smaller wheels be four inches diameter and the two larger twelve inches, the mandril will revolve with only one ninth of the speed that it did before. For turning a cylinder the slide-rest and tool must be set in the same manner as in the foot-lathe; and the wheels B, C, D arranged for a very slow motion of the rest along the beds: the lathe, when set in motion, will require no more attention until a fine spiral line is cut, enveloping the cylinder along its whole length; the rest has then to be shifted to where it started from, or by a simple contrivance be made to work its way back again, the tool being set out a little deeper each time until the surface is completed.

Screw-cutting with the power-lathe is a simple and beautiful operation: the point of the tool is made exactly the shape of one of the spaces between the intended threads and having the same rake or inclination; at each revolution of the mandril the rest must move through the distance from one thread to the next. The circumference of the screw has no effect upon any part of the arrangement but the inclination of the tool. When the screw is required to be double or treble-threaded, that is, having two or three intervening spirals upon the same stem, the rest must be moved forward a proportionate distance at the commencement of the second and third threads.

By a slight adaptation, the lower slide of the rest may be connected with the gear of the mandril, for turning oblique, convex and concave work.

F F F is the drilling-frame, for working drills and cutters, fixed in the rest; the two uprights are fixed firmly to the bed of the lathe, and the two shorter perpendicular pieces swing on centres close to the top of the uprights, each pair being kept steady by connecting rods, which are omitted in the diagram to prevent confusion. The upper rod is made to revolve by a band passing round the mandril-pulley and pulley G; and the lower or swinging rod is moved by means of another band passing round the pulleys H and I, which can be shifted along their respective rods to suit the position of the rest. The drill or cutter is placed in the rest, and is driven by a thin band from the pulley I. The swinging of the lower rod and pulley, I, accommodates the different positions of the rest and traversing of the slide, and the band is kept tight by a cord and weight at the back acting upon the swinging frame. A brass or gun-metal dividing-plate, with several circles of holes, is fixed on the mandril in front of the large wheel. If it is required to drill any number of holes in a plate, the drill-stock, *Fig.* 11, is placed in the slide-rest and connected with the pulley I, as before described; and the mandril is kept at rest by a pointer, which is attached to a spring and fixed to the head-stock, and falls into the various holes of the dividing-plate.

Fig. 11.

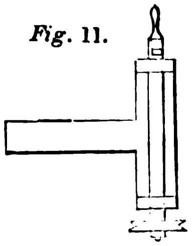
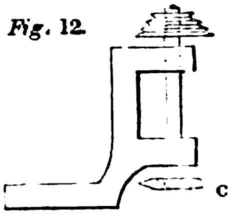


Fig. 12.



By drawing the drill-frame to or from the centre of the work, holes may be drilled in straight lines across the centre, and, by shifting the dividing-plate, in circles; by the combination of the two movements the holes may be placed in curves and spirals in any direction. By giving motion to the mandril, and connecting it with the slide-rest screw, spiral grooves may be drilled upon the surfaces of plates, cylinders, or cones. The points of the drills must be of the exact shape of the intended grooves. By these means many operations may be performed with ease and accuracy which it is almost impossible to manage in any other way.

The cutting of toothed wheels is one of the most valuable applications of the lathe. The mandril is kept stationary, as for drilling, by the dividing-plate and pointer: a circular cutter, C, *Fig.* 12, is fixed in the rest, in the same manner as the drill-stock, but with the spindle perpendicular to the beds; in forming the cutter, a piece of steel from one to two inches diameter is turned of the exact shape of a space between two intended teeth; deep notches are then cut all round, which give it the appearance of a very coarse circular saw. The wheel to be cut is fixed on the lathe, and the upper side of the rest set parallel, obliquely, or at right angles to the beds, according as the wheel to be cut is spur, bevil, or crown; the cutter is set in motion by a band from the swinging frame, the winch of the slide turned slowly till a notch is cut across the edge of the wheel, the dividing-plate is then shifted one or more divisions, according to the number of teeth in the wheel, another notch is cut, and the first tooth finished: this is repeated as many times as there are teeth in the wheel.

The circular cutter may be employed in many other ways, such as cutting grooves and flutes, which, except for sudden curves, it performs better and much more rapidly than the drill. For cutting straight grooves both the drill and cutter are entirely superseded by the *planeing-machine*, a modern invention of the greatest importance. It supplies what was one of the greatest wants of the engineer, and might appropriately be called the *straight-lathe*. A large iron table from two to twelve feet long, full of holes, by means of which the work is bolted down, is made to traverse backward and forward by an endless band, or other contrivance, set in motion by a hand-winch, or steam or other power; over the centre of this table, at some distance above it, is mounted a tool-carriage, which traverses by means of a screw along the width of the table in the same manner as the slide-rest, only the tool is vertical instead of horizontal; the work being bolted to the table, the tool cuts a straight line every time it passes under it, and by moving the tool after every cut a uniform surface is produced. In this manner the largest work is brought to a regular surface in a comparatively short space of time, and metal plates are applied to many purposes of a size which was never before attempted. The bed of a billiard-table is now frequently made of one piece of iron, planed by these machines with the greatest accuracy.

For cutting grooves or flutes in cylindrical work, two small puppets carrying centres are screwed to the table to support the work, and the parts where the grooves are required are brought under the tool by means of a division-plate fixed to one of the puppets: a revolving cutter may be used instead of a fixed tool for cutting long pinions and terminating flutes. The whole arrangement of this powerful engine, it will be seen, is precisely similar to the straight-line chuck of the rose-engine hereafter described.

Excentric Turning.—In enumerating the different chucks, we purposely omitted the excentric and oval, as they give their names to the respective kinds of turning for which they are used, and may therefore be considered rather as parts of the lathe itself than as mere appurtenances. *Fig.* 13 represents a single excentric chuck: P is a strong plate which screws on the nose of the mandril, and is turned perfectly true on the face; two dovetailed pieces are screwed upon it near the edges, between which the slide, S, works by means of a screw fixed to its under surface, and working in a nut in the centre of the ground-plate; upon the slide is fitted a circular plate, which turns upon a centre, and has its edge cut into a number of teeth according to the size of the chuck; C is a click with one or two teeth fitting between the teeth of the wheel, and held in its place by a spring under the other end; sometimes the teeth of the click are fitted into a groove, and acted upon by a fine screw when the wheel is required to be moved through a less space than one tooth, but this purpose is effected in a very superior manner by a second plate turning upon the first, and provided with an endless or micrometer screw; the great advantage of this arrangement is, that a division may be taken by the screw without altering the place of the click; the nose, N, for carrying the work, is fixed to the upper plate. The double excentric chuck is made in the same manner, but it has a second slide, at right angles to the first, on the back of the ground plate. The two slides are necessary for some sorts of work, but much may be done with one slide only. In common turning the use of the excentric chuck is to bring any required point in the work in a line with the centre of the mandril; thus circular holes may be cut in any part of a plate, the edge may be hollowed out by any number of curves of the same or different radii, and polygons with curvilinear sides may be produced with the greatest accuracy. The following description of the method of producing three simple figures will give a general idea of the application of the chuck. To produce *Fig.* 14, set the slide so that the click-plate run concentric with the mandril; cut the outer circle which forms the four curves on the ends of the arms; screw the slide out the length of the radius of the circle; draw the tool nearer to the centre, and cut one of the segments upon the edge; move the click-plate one quarter round, and cut the second segment, and so on for the other two.

Fig. 13.

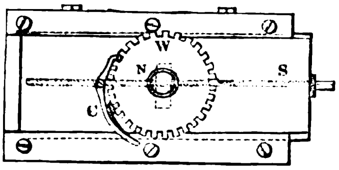


Fig. 14.

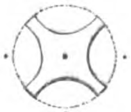


Fig. 15.

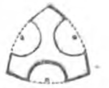
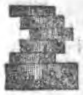


Fig. 16.



For *Fig.* 15, mark a circle the full size of the intended figure; draw out the slide half the diameter of the circle as before; draw the tool farther from the centre until it will cut one of the three curves forming the sides of the figure; turn the click-plate one-third round for each of the other two sides: screw the slide half-way back; draw the tool nearer to the centre; move the click-wheel one-sixth for the first of the smaller segments, and one-third for each of the others. *Fig.* 16 represents a pattern cut with the rest parallel to the side, instead of the face of the work, and is much used by ivory and hardwood turners to ornament their work; the material being turned of the size of the base, the slide must be drawn out one-third of the radius, and the lowest of the smaller circles cut with a flat-faced tool; the slide is then returned to its place, and the second circle cut in the same manner, but concentric with the base; the third is produced by drawing the slide out the same distance in the opposite direction, and so on, producing a pillar of small circular discs placed in a zigzag direction, or it may be varied by turning the click-wheel one-sixth or so for each disc after the first, without altering the excentricity; they will then be arranged spirally. In ornamental turning the excentric chuck is mostly used for cutting patterns upon the surface of the work without altering its general outline. Thus, in ornamenting ivory or wood-work, circles and curves are laid in an infinite variety of positions upon the face and edges of the work; and a very pleasing effect is produced by the assemblage of prominences caused by the intersection of the circles, which must be cut with tools sharpened at a very acute angle, and generally double-angular or V-shaped.

The ivory-turner frequently uses a small instrument called an *excentric cutter*; it is formed like the drill-stock, *Fig.* 11, and moved by a bow; the cutting point can be fixed at different distances from the centre by means of a groove and screw. In conjunction with a click-plate upon the mandril, the cutter answers many of the purposes of the single excentric chuck, with this great advantage—that it can be used to ornament the sides, edges, or curves of work, while the excentric chuck, without several troublesome adaptations, will only work upon a flat surface; besides, in using the cutter the lathe is stationary, and the labour therefore much less. With the single-slide excentric chuck and the mandril at rest, the cutter will produce patterns which would otherwise require the double excentric, such as cutting circles in a straight line not intersecting the centre of the mandril.

Geometric Turning.—When the work revolves on the lathe, and the excentric cutter is driven by a band in connection with the mandril, in the same manner as the drill-stock in *Fig.* 10, a great variety of very complicated and beautiful epicycloidal and other curves may be cut, which without the cutter require an elaborate and exceedingly expensive chuck. This geometric chuck is an excentric, with the addition of an arrangement for giving motion to the work upon the chuck, and independent of the mandril; fixed to the headstock and concentric with the mandril is a toothed wheel which, as the chuck revolves, drives another and smaller wheel on its under surface: this latter is connected with another toothed wheel which causes the click-plate and work to revolve. The patterns may be infinitely varied by altering the relative sizes of the wheels; and by introducing an extra wheel, and so causing the work and chuck to revolve in opposite directions at the same time; and lastly by changing the position of the tool. The number of different curves that can be produced by these changes and the great dissimilarity to each other can hardly be conceived. In the article Trochoidal Curves, in this work, are many well-executed specimens of curves cut by the geometric chuck. Suardi's geometric pen produces the same effect by different means; but the latter is merely for tracing, not cutting, and is therefore inapplicable to the lathe. [Pen.]

The excentric and geometric chucks are much used in producing patterns on plates and blocks for printing and embossing, sometimes in conjunction with rose-engine turning, which to the unpractised eye it much resembles.

Oval Turning.—Until the invention of the oval chuck the production of true ovals was a matter of considerable difficulty, and the cutting of them upon the lathe an impossibility; with it we can turn ovals of all sizes and proportions with almost the same ease as circles. The construction of the chuck is simple. Upon the front of the headstock H, *Fig.* 17, is placed a ring, held by screws through its two arms and the projecting pieces on each side of the headstock; a screw is placed in one arm of the ring to draw it out excentric to the mandril. *Fig.* 18 shows the front of the chuck with a slide moving between dove-tails on a ground-plate; the ground-plate, as shown in *Fig.* 19, has two slits cut from the centre boss, which screws on to the mandril, nearly to the circumference; two small studs are cast upon the back of the slide, which are made to work easily in the two slits, and stand up just above the face of the ground-plate; when the slide is in its place two steel rubbers with straight polished faces are screwed to the studs, and stand out at the back of the ground-plate at right angles to the slits, as seen in *Fig.* 19. The ring being fixed in its place upon the headstock, the chuck is screwed upon the mandril, the rubbers clasping the ring, which must be kept perfectly smooth and well oiled; the excentricity of the ring, acting upon the rubbers, draws the slide out of the centre in opposite directions alternately, and upon the tool being applied an oval will be described upon the face of the work, having the shorter diameter in proportion to the distance of the tool from the centre, and the longer to the excentricity of the ring.

Fig. 17.

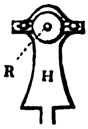


Fig. 18.

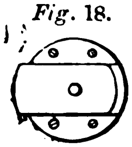
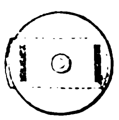


Fig. 19.



For ornamental work the oval chuck is provided with a click and sometimes a micrometer plate, like the excentric chuck, for placing the ovals in different directions; and frequently the oval and excentric are combined in one chuck (with a stop to fix the oval slide when not in use): by this compound chuck ovals may be laid in excentric circles upon the face of the work, and form a pleasing variety when mixed with circular excentric work or engine-turning.

Rose-engine Turning.—Of all the different sorts of ornamental turning this is by far the best adapted for embellishing small articles, and accordingly it has for a long time been in very general use for gold, silver, and gilt-work: it is besides applied to the production of ground tints, borders, and ornaments on copper, steel, and wood, rollers for printing and embossing calico, leather, and paper; and many other sorts of ornamental work. Considering the great variety of articles to which it is applied, it is surprising how few, even amongst workmen, are acquainted with the machine by which it is performed; and general as has been its employment for these forty or fifty years, there is no English work with which we are acquainted that contains a good description of it.

The origin of the rose-engine, like that of many other machines, is entirely unknown: the French, who are very expert in the use of it, and applied it to the arts long before it was at all generally known here, lay claim to its invention, but a similar machine was in existence in England at or before the time of Sir Isaac Newton; and we have seen some specimens of its work upon wood which were stated upon credible authority to have passed through his hands.

It is not however so much our province to search for its history as to explain its structure and application.

An unsteady lathe, which in revolving produces an irregular circle, is a rude approach to the rose-engine, and may very possibly have furnished the first hint for its invention.

H, *Fig.* 20, is a headstock very similar to that of the lathe; but instead of being bolted firmly to the beds, it is only supported upon the conical points of two screws, C C, in the two metal standards, A A, fitted and bolted to the bench or bed, which is here drawn in section: in the front and back of the headstock, near the bottom, are two sunk centres to receive the conical points of the screws, which must be tightened until the headstock moves upon them, when oiled, freely but without shaking; the screws are then secured by washers that run upon them, and tighten against the standards. The upper part of each of these standards carries two other screws at right angles to those described, for the purpose of holding the headstock steady when the rose-engine is to be used as a common lathe. Two of these screws are shown in the front of the engine (*Fig.* 21). The mandril works in bearings, generally of soft metal, as best calculated to produce the smoothness of motion necessary to give that brilliant polish upon which the effect of engine-turning upon gold or silver so much depends. Upon the mandril are mounted the pattern guides, or rosettes, circular plates of gun-metal or brass, each about half an inch thick, and having two patterns or waves upon its rim. The rosettes are of two sorts, fixed and shifting. The fixed, F, are screwed to a collar turned upon the mandril itself; the moveable, R, are fixed upon a cannon, B (*Fig.* 20) (these latter rosettes are drawn in section to exhibit the cannon); the plate M is fixed to the cannon, and the rosettes are prevented from turning by a

Fig. 20.

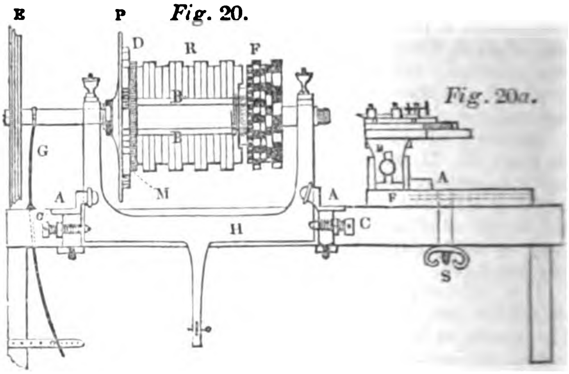
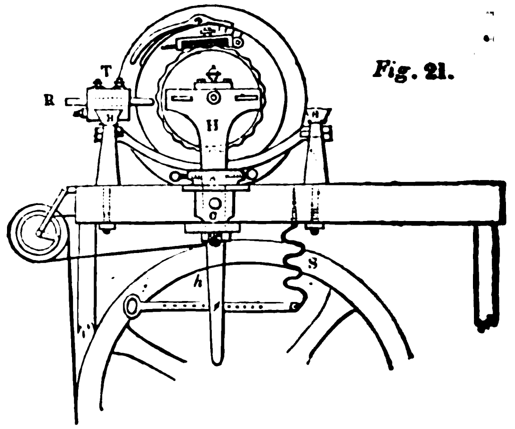


Fig. 21.



feather which fits into a notch in each of the rosettes: a nut at the end of the cannon screws all tight against the plate M.

The plate D is put on the mandril at the back of the cannon plate M, but independent of both; behind this is another plate P, fitted on to the mandril and turning with it; at the back of this plate is a nut, which is tightened until the cannon requires some little force to turn it upon the mandril with the hand. On the large plate P, is a spring-click, which falls into notches cut in the plate D, which itself carries an endless screw working into a half thread cut on the edge of the cannon plate M.

On each side of the mandril frame, and parallel with it, is a strong bar, the ends of which are marked B in *Fig*. 21, supported upon pillars screwed firmly to the bench, and connected by curved bars passing beneath the rosettes.

T is a carriage for holding the rubber R, by means of the two screws in the top of the carriage: the rubber is a small bar of steel, three or four inches long, and the breadth of the rosettes; the ends are filed away above and below, producing a more or less blunt curve with a straight face against the rosette, and are hardened and well polished.

Screwed into the bottom of the headstock is a strong arm, *h*, *Figs*. 20, 21, with a square hole near the bottom, to receive a smaller arm pierced with holes; one end of this latter is attached to a strong spring S, and by placing a pin in one or other of the holes in the small arm, the spring may be made either to press or pull the arm *h* with less or greater force.

The rubber-carriage T being moved along the bar B, till the end of the rubber is exactly opposite the face of the rosette to be employed, and fixed there by the back-screw, the spring set to *pull* the arm *h*, and the side screws in the standards A turned back until the face of the rosette rests upon the rubber R, the engine at each revolution will produce a copy of the indentations upon the face of the rosette, but of course varying in the proportion of their lengths according to the distance of the tool from the centre.

The engine is moved by a hand-winch with a band passing round a foot-wheel, and another connecting a small pulley on the crank with the mandril-pulley E, in the same manner as the slow motion of the foot-lathe, *Fig*. 2.

The slide-rest, though in principle nearly the same as that represented in *Fig*. 9, has several adaptations well worthy of attention. In the first place, it is of the greatest consequence that the height of the tool should be precisely the same as the centre of the work, or the pattern will appear twisted; and, as the bed or bench of the engine is of wood, metal injuring the smoothness of the work by a tremulous motion that always accompanies it, and the rest not always fixed on the same spot, some means of adjustment is found necessary. In rests of the very best construction it is provided in the following manner: the tail-piece or foundation-plate of the rest F, *Figs*. 20, 22, has a hollow cylinder C, fixed in the middle of one end, just beneath the triangular bar B. and standing up level with the sides of the stock A. The bar B, which has a piece at each end fitting into dovetails in the sides of A, has a cylindrical piece which fits accurately into the hollow cylinder C, and can be raised or lowered at pleasure by a ring or nut N, working upon the outside of C; the rest being placed in the required position, and fixed to the bench by the screw S, *Fig*. 20; the capstan-headed screws, *Fig*. 22, which hold B in its place, are loosed, the tool centred by means of the nut N, and the two side screws again tightened. The stock A moves round upon the cylinder C, and can be fixed at any required angle by the binding nut O.

Fig. 22.

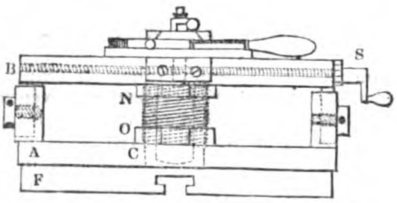


Fig. 23.

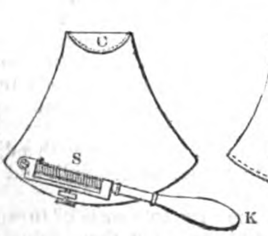
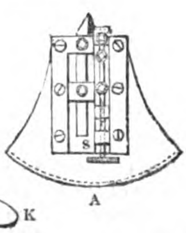


Fig. 24.



The top of the rest, which traverses along the bar B, by means of a screw throughout its length, provided with an index-plate and winch-handle S, is composed of two parts, the ground-plate, *Fig*. 23, and another plate, *Fig*. 24, which carries the tool-slide. The upper plate moves round a centre by means of an endless screw fixed to the lower plate, and working into the edge of the former, which has a hollow half thread to receive it. When cutting, the tool must of necessity be some little distance in advance of the front of the rest, and when the upper plate moves upon a centre-pin, fixed in the lower plate, the point of the tool, being beyond the centre, is thrown out of its position in a direction opposite to the traversing of the plate. This is avoided by the following simple but ingenious arrangement: upon the front of the ground-plate, 23, and close to the edge, is fixed a segment of a circle, the centre of which is shown by a dot beyond the edge (about three-eighths of an inch from it); the segment is conical, the larger side upwards; in the under part of the traversing-plate, 24, is a cavity which fits accurately upon the segment. If the front of the rest is placed three-eighths of an inch from the work, the point of the tool will not be moved from its place, though the plate be made to traverse through its utmost range. By these means another advantage is gained, namely, that the upper plate, with the tool-slide and its appurtenances, may be instantaneously removed from off the ground-plate, by merely loosening a small screw at the back of the endless screw, which presses the latter into the thread: this is very convenient, either for getting a better view of the work in case of any irregularity or doubt, and also in clearing away chips, which frequently get under the plate and impede its action.

We have now described all the parts of the engine necessary for concentric circular face turning; but the engine is also capable of turning the sides and edges of work, for which purpose it is provided with a separate set of waves cut upon the sides of the rosettes, some of which are made of larger diameter than others for that purpose. The rubbers are shaped at the side to correspond, the mandril has an endway-motion within its bearings, and is acted upon in either direction by the lever-spring G, *Fig*. 20, which has its fulcrum upon the bench: its upper end is forked, and fits a groove in the mandril, and the lower held by an arm and pin.

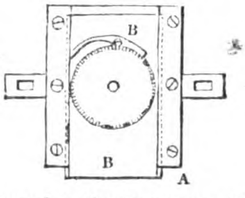
For side-work the slide-rest is placed parallel with the bench as in common turning.

The excentric and oval chucks are equally applicable to the rose-engine, and need no further description.

The square, or *straight-line chuck*, on the contrary, is peculiar to the rose-engine, and forms a very material part of it; the object of it is to lay the patterns in a straight, instead of a circular direction. Engines are made for this especial purpose, and a very excellent description of one, under the name of 'machine carée,' may be found in the 'Manuel du Tourneur.'

Fig. 25 represents the straight-line chuck; the square frame A, A, is fastened to the two arms of the headstock, shown in *Fig*. 21, by bolts and nuts, or wedges; B, B, is a slide, connected with the nose of the mandril either by a chain or, what is better, a rack and pinion; on the face of the slide are click and screw-plates, and a nose to receive the chucks, as in the excentric and oval chucks.

Fig. 25.

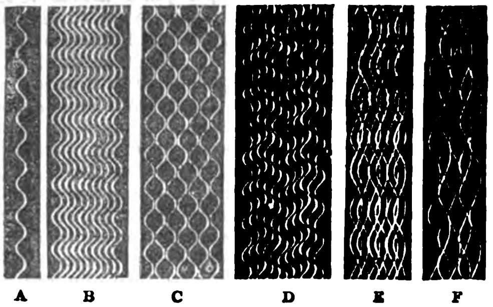


This chuck, with the slide-rest set parallel to its face, is an exact representation, on a small scale, of the planeing-machine before mentioned.

The patterns produced by the straight-line chuck offer the simplest means of explaining the manner in which they are compounded from the simple waves on the rosettes.

We mentioned several sets of notches in the plate D, *Fig.* 20, to receive the tooth of the click on plate P; the distance of the notches apart is in proportion to the rosette: if it have eighteen waves, the notches used must be one-thirty-sixth of the circle apart, and so on for all other rosettes. A, *Fig.* 26, is the wave of which the patterns B, C, and D, are composed. B is produced by taking one division of the slide-rest screw after each wave is cut.

Fig. 26.



After cutting the first wave of C, take one notch with the click and two divisions of the slide-rest screw for each succeeding wave. For D, place the click in a set of notches three times as close to each other as those used for C, and for each wave take one notch and one division of the rest-screw, reversing the direction of the click at every third wave. For the last two patterns a rosette with only half the number of waves is employed.

E is produced by laying the second wave upon the first, but alternating: this is done by taking the click without moving the rest-screw; one division on the screw for the third, and the click only for the fourth; then taking two divisions on the screw for the fifth, proceed as before. For F place the click in a set of notches of double fineness; take one notch and one division of the screw for the second wave, two notches only for the third, and one notch and one division for the fourth.

These specimens will serve to show the immense number of patterns which may be produced with twenty or thirty rosettes and their combinations. Many curious patterns are produced by using two rosettes, one fixed to the mandril, the other on the cannon: the former, not being affected by the click, will always lay the waves in the same position, while the latter may be shifted as above described, and by having one of the rubbers to advance and recede, the relative quantity of the two waves may be varied at pleasure.

For cutting copper and steel plates, or wood blocks, the tool is sharpened with two acute angles, but in turning gold and silver work the quantity of metal taken off is required to be so minute that the two faces of the tool must be rubbed to such an obtuse angle as to appear almost straight; for this purpose a small machine is used with an arm, against which the tool is held, that can be fixed at the required angle by a graduated quadrant: some of these sharpening tools are rubbed upon the oil-stone, others are screwed to the bench and the oil-stone rubbed upon a flat surface, with a small hole in the centre through which the point of the tool is advanced against a guide. The tool after being thus sharpened has the edge rubbed upon copper or Turkey-stone, and afterwards polished upon a piece of buff-leather charged with crocus.

Close to the side of the tool in the rest is placed a stop, or touche, as it is called, to regulate the depth of the cut: the touche has a very small face highly polished, which rubs upon the work in advance of the tool, and can be drawn in or out by the sliding piece and screw S, *Fig.* 24. This touche is used with all irregularly-shaped work; but when the surface is perfectly flat, as it must be to produce superior work upon plates and blocks, the tool-slide is kept out to the required distance by a screw or pin and stop.

It is for turning watch-cases, lockets, and other raised or domed work, either circular or oval, that the screw S and false centre C, *Fig.* 23, come into operation. The work being fixed on a chuck with cement, and set perfectly true to the mandril, the rest must be placed as before directed, so that the centre of the segment and quadrant is on the face of the work. The screw S, *Fig.* 23, is then turned back until the tool is at a right angle to the part to be first cut; a plain circle or thread is cut round the outer edge of the work, and a rosette being brought into action the first wave is cut round close to the thread; the moving of the click and rest-screw depends of course upon the pattern to be turned. But after each alteration of the latter the quadrant-screw S must be turned till the tool is at a right angle as before.

The number of adaptations, on account of the various and irregular shapes of the different pieces of work to be engine-turned, is very large, and would take up far too much space to describe. We shall only mention one for holding small cylinders, such as pencil-cases, on the straight line chuck: the work is placed on a steel mandril which fits it tightly, and is rubbed over with a little sealing-wax to prevent the work shifting its position. This mandril is held upright in a chuck, which has a small dividing plate and screw with a square hole at the top, and a pointed screw at the bottom. The tool is set exactly opposite the centre of the work, and the divisions are taken by turning the mandril of the chuck instead of the rest-screw.

Cutting the rosettes, which every engine-turner ought to do for himself, is an operation of considerable nicety, as the waves are mostly very shallow, and the rosettes large, to make them work easily, and the slightest fault in a wave will be repeated through the whole work. They are generally placed upon a lathe, and the indentations cut out with a circular cutter, larger or smaller according to the length and depth of the wave. Sometimes a straight cutter is used, which passes through a square hole in the centre of a piece of iron that swings in a fork-shaped stock, and can be set out to any required radius and fixed by a screw. The face of the cutter is angular, and is slowly drawn by the rest-screw across the width of the rosette; a little only is cut out at a time, and the rosette is gone over several times until the waves meet each other, or are cut up. This is a slow process, but when carefully conducted produces a beautifully smooth rosette. The waves produced by both of these methods are divided from each other by a sharp line, which, except for rosettes of the highest numbers, must be rubbed down with great care, either by polishing or working very gently in the engine against a rough rubber. Rosettes of few waves are copied, or engine-turned, by means of an original guide placed upon the nose of the engine.

In the 'London Journal of Arts and Sciences,' vol. i. 1820, is a full description, with engravings, of two very superior machines for engine-turning, invented by Messrs. Perkins and Heath, in which the rosettes are dispensed with, and their place supplied by an excentric wheel, or cam, which produces one wave only; but, by means of toothed wheels, as many of these waves as are requisite are introduced during each revolution of the mandril. This engine produces an immense variety of patterns, with the very great advantage of all the waves being precise counterparts of each other, not being subject, as is the case with rosettes, to irregularities of workmanship or partial injury.

To this circumstance, among others, is owing the extraordinary beauty and regularity of the patterns cut by Messrs. Perkins and Co. on Bank-note and other plates, specimens of which are worthy of the most attentive consideration of the engine-turner. These gentlemen also introduced a system of transferring the patterns cut upon a steel roller, afterwards hardened, to any requisite number of steel plates: thus the patterns are reversed, producing white lines on a coloured ground, as in letter-press printing. Sometimes, after part of the pattern is thus transferred, the remainder is cut upon the plate itself, producing the effect of a mixture of copper-plate and letter-press printing upon the same plate.

Work of this description is generally cut with a diamond, as a steel tool is liable to break, or get dull, and destroy the uniformity of the effect.

We have enumerated the principle sorts of turning, and described the means employed; but there remain many ingenious and useful machines and tools which we have necessarily left unnoticed, and we refer our readers, for further information, to the *Manuel du Tourneur*, par L. E. Bergeron, 3 vols. 4to., Paris, 1816; *L'Art de Tourner en Perfection*, par C. Plumier, fol., Lyon, 1701, and P. Dasormeux, Paris, 1824; *Transactions of the Society of*

Arts, vols. xlvi., xlvii., &c.; *Mechanics' Magazine*, Dec. 30, 1826; July 21, Dec. 15, 1827; March 7, and June 20, 1829; June 28, 1834, &c.; *Ibbotson's Specimens of Excentric Circular Turning*, and *Hand-Book of Turning*, Lond., 1842.

TURNIP, the common name of the *Brassica rapa*. The turnip in its wild state is a native of Great Britain, and is frequently found in the borders of fields and waste places. It has a caulescent, orbicular, depressed fleshy root, with the radical leaves scabrous and lyrate, whilst those of the stem are nearly entire and smooth. When wild, it varies much in height according to the soil, and always bears yellow flowers. By cultivation the size of the plant, especially the root, is sometimes enormously increased. The young leaves and buds of the turnip are gathered and eaten under the name of 'turnip-tops.' The roots consist of a large mass of soft cellular tissue, in which starch and sugar are deposited. The root of the turnip contains a large proportion of water. Dr. Lyon Playfair, in a late analysis of the food of cattle, made at the request of the Royal Agricultural Society, gives the following as the ingredients in 100 parts of turnips:—

Water	89
Unazotised matters (starch and sugar)	9
Albumen	1
Inorganic matter	1
	—— 100

There are several sorts of turnips known to agriculturists, which belong to the varieties *Brassica rapa depressa* and *B. r. oblonga*. The former affords the flat or roundish turnips, the latter the tankard or decanter sorts. In Dauphiny a variety of the common turnip, the *B. r. oleifera*, is grown for the purpose of procuring oil from its seeds. It is not however more productive in this respect than the *B. campestris* and *B. napus*. The turnip is sometimes cultivated in the kitchen-garden, but its qualities for culinary purposes when thus grown are never so good as when obtained from open fields.

The Swedish turnip, so well known in agriculture, is the produce of *Brassica campestris*, and is a variety of that species known under the name of *B. c. Rutabaga*.

TURNIP-FLY, a name popularly applied to the *Haltica* or *Altica*) *nemorum*, a little insect belonging to the order *Coleoptera*, which annoys the farmer by destroying his crop of turnips, when in the early stages of their growth. The species of the genus *Haltica* are remarkable for their power of leaping, which is effected by means of the peculiar formation of their very thick hind legs. They are among the smallest of beetles, and are variously coloured with green, brown, or yellow, often brightly shining. Some destroy the cabbage, others flax, others tobacco, or hops; but the turnip is the greatest sufferer from the ravages of these little creatures, which, though small in size, are many in number. They love sunshine, warmth, and fine weather, and eat away the surface of the young leaves of the plant with voracity. The larva feeds within the full-grown leaf, in which the egg has been laid and attached by its parent, but does little or no mischief to the growth of the plant. It is the beetle which destroys the first smooth leaves or cotyledons of the turnip. It scents out the turnip crop from a great distance, and flies towards it even against the wind. It feeds by night, and during the day retires under the cotyledon. The parent insects are to be seen in the earliest fine days of February, and do not disappear before the end of October, but they do not feed much after the latter end of September. There are five or six broods of these in a summer. Besides the *Haltica nemorum*, which is of a shining black, with a yellow stripe down each elytron, the *Haltica similis* and *H. flava* are also destructive to turnips.

The destruction caused by these insects may be conceived when, so long ago as 1786, Mr. Young stated that the turnip crop destroyed in Devonshire alone was valued at 100,000*l.*; consequently, many entomologists have directed their attention both to the inquiry into the habits of the animal and the finding a remedy for the mischief it causes. Admirable essays on the subject have been published in the 'Entomological Transactions' by Mr. Le Keux, and in the 'Journal of the Agricultural Society of England,' by Mr. J. Curtis, which may be consulted with advantage by the farmer.

Among the remedies which have been proposed are fumigation, watering with weak brine, steeping the seed in brine, applying lime and soot to the land, and the application of wormwood decoction and road-dust. The last has been greatly recommended in Germany, and there is an essay on the subject, by M. Wundram of Dorste, Hanover, in the 'Transactions of the Royal Agricultural Society of Vienna.' But English authors question its efficacy, and as yet it is very doubtful whether we have discovered any efficient means of opposing this mischievous little beetle.

TURNIPS. *Brassica rapa.* This well-known plant is cultivated for its bulbous roots both in the garden and the field. As a culinary root it has been prized from the earliest times, and many varieties have been cultivated for the table; but it is those of a larger kind, cultivated in the fields, which form so important a part of the most improved systems of agriculture on all light soils, that the success of the farmer is, in general, proportioned to the quantity of turnips raised on his farm. They are the great foundation of all the best systems of cropping, by supplying the manure required for the subsequent crop, and, at the same time, clearing the land of all noxious weeds, by the numerous ploughings, stirrings, and hoeings which they require.

Turnips were first raised upon land which had already borne a crop that was reaped early in summer, and on fallows which had been worked and cleared early, so as to leave a sufficient interval between the last ploughing and the time of sowing winter corn to have a tolerable crop of turnips. These turnips however, which are still cultivated by the name of stubble or eddish turnips, never grow so large as those which had been sown earlier on land well prepared and highly manured.

The regular cultivation of turnips on a large scale was originally introduced from Flanders into Norfolk two centuries ago, and from Norfolk was brought into the south of Scotland and the north of England about a century after. It was long confined to one or two individuals, who cultivated turnips very successfully; but at last it spread, and was greatly improved by introducing the row culture, according to Tull's system, which acquired the name of the Northumberland mode of cultivation. The usual mode of sowing turnips both in Flanders and in Norfolk was broadcast, and, as the labourers in both countries became very expert in hoeing them out at regular distances, this mode was long preferred. In fact the cultivation of turnips in rows is scarcely practised at all in Flanders, and, notwithstanding its evident superiority in respect to quantity of produce and economy of labour, it cannot be said to be yet universally adopted in Norfolk and the neighbouring counties; so slowly does every agricultural improvement spread among the great mass of farmers. All farmers however who have any pretensions to a good system of cultivation adopt the Northumberland plan, of which a short account will be found in the agriculture of that county in this work. But there are some particulars not mentioned there which are worthy of notice, and which lead to still further improvements in the practice. The great object on poor light lands, especially those which have lately been brought into cultivation, is to raise a crop of turnips; for when once this is obtained, and the land has been improved by the folding of sheep upon it, there is no great difficulty in maintaining the fertility thus produced by judicious management and frequent green crops. Great improvement in poor soils has been effected by the introduction of ground bones as a manure, which have the peculiar property of favoring the growth of the turnip, and have consequently been used on poor light sands and gravels to a great extent, and with unvaried success, without much help from farm-yard manure. It has however been found that a much greater profit is obtained from the land by uniting the regular application of farm-yard dung with that of the bone-dust. For this purpose the best farmers prepare their land, where they intend to sow turnips, early after harvest, by giving it as complete a cultivation as they can before winter; and they put on it a good coat of manure, and plough it in. In the beginning of summer another ploughing is given, with repeated harrowings, to destroy the weeds which have sprung up. If the subsoil is dry, or the land has been thoroughly drained, the seed may be drilled in rows from 2 feet to 30 inches apart, with bones or any equivalent artificial manure on the flat surface. The turnip-seed can scarcely fail to vegetate soon: less danger arises from dry weather than if they were on the top of a ridge, and the intervals can be readily stirred by the plough or any other instrument adapted to the purpose. The manure, which has had time to incorporate with the soil and to impart to it the various gaseous products of its decomposition, is in the best state to nourish the young plant, until it can push forth its roots and feed, as it were, on the bone-dust: a more rapid growth is ensured, which is the best preservative against the fly; and experience has proved that this is a much more certain way to insure a good crop of turnips, especially of swedes, than the old method of putting all the manure immediately under the seed in the rows, where it often remains inert if dry weather comes on soon after the seed is sown. The quantity of manure put on in autumn, or very early in spring, depends on the means of the farm: if ten cubic yards of short dung can be afforded per acre, the crop of turnips will amply repay it, and twenty bushels of bone-dust or less per acre will be sufficient to drill with the seed. Long fresh manure may be safely ploughed in before winter, which would be very improper in a light soil if used in summer. This will be rotten before the turnips are sown, and all the expense of forming dunghills and turning them over is saved. There is no danger of the manure being wasted; for whatever weeds may be produced will be ploughed in and returned to the soil. All the nutritious parts of the decomposing dung will be absorbed by the earth, and none of them will evaporate. Where farm-yard manure is scarce, half the above quantity may be used, and a fair crop of turnips may still be expected. We have ourselves followed this method with abundant manure, and also with half the usual quantity, the success being always in proportion to the quantity of farm-yard manure.

The early vegetation of the seed is essential to a good crop of turnips. In its young and tender state it is liable to a variety of accidents. Its great enemy is the turnip-fly (*altica nemorum*), which appears always in great quantities, if there is any continuance of dry weather. The more frequently turnips are sown on the same ground the more abundant is the fly, but where the surface has been pared and burned there is seldom any loss from this cause. Many remedies have been proposed for this evil, and some with great confidence. It appears that the fly remains in the state of an egg in the ground, and that it is hatched when exposed to the light and heat of the sun. The time at which it begins to attack the seed-leaves of the turnip coincides with their vegetation, and it has therefore been proposed, with some appearance of reason, to let the insect have the start of the turnips, by leaving the land some time undisturbed before the seed is sown, and carefully cleaning it, so that the insect shall find no food, and consequently die. This is supposed to require 10 or 12 days to effect. The seed is then drilled and the land rolled, and it is asserted that the ravages of the fly are thus entirely prevented. However this may be, it is generally found that in moist weather the fly does comparatively little harm, as then the vegetation is rapid, and the plant, when once it has put forth its rough leaves, is considered safe. Whatever therefore accelerates the vegetation, will secure the growth of the turnip. Hence the advantage of dunging the soil before winter, by which means it is enriched uniformly, and a great portion of the manure, having become soluble, absorbs moisture from the atmosphere. In very dry seasons, if water is at hand, it is well worth while to water the newly-sown rows by means of a common water-cart; and if some liquid manure be mixed with the water, the effect will be astonishing. By means of two leathern hose two rows may readily be watered at once; and if the pond or stream be not above half a mile off, a vast extent of ground may thus be watered in one day. Nothing brings on vegetation so fast as diluted liquid manure, care being taken that it be not too strong. The best time for watering is in the evening or early in the morning; and if in a fine summer's night the water-cart were used before daylight, there would be no great inconvenience to the horse or his driver. It sometimes happens in soils rather compact, that a crust is formed on the surface which has been harrowed fine and rolled, and this impedes the vegetation by excluding the air necessary to germination; in this case no better remedy can be applied than watering, which softens the crust and lets the young plant through. As soon as the turnip-plant has put forth its rough leaves, the intervals between the rows should be stirred with a light plough drawn up by one horse. The plough can be made to go within an inch or two of the plants, throwing the earth from the row into the interval: a small harrow, which can be set to any required width, is then drawn between the rows to loosen the earth raised by the plough. This greatly increases the absorption of moisture and invigorates the young plants. They may now be thinned out in the rows by means of a hoe about 12 inches broad, which will hoe out all the superfluous plants leaving little tufts a foot or more apart. These tufts are thinned out by hand, leaving only one healthy plant in each. Thus the turnips are left at a proper distance, and, having ample room, will soon cover the rows. A horse-hoe is now drawn between the rows to eradicate all weeds and keep the soil open for the fibres of the roots to shoot in. It is not advisable to throw the earth over the turnips, unless it be just before winter, to protect them from the frost; on the contrary, in wet weather the earth is more likely to cause the turnip to rot than to help its growth. The fibres which draw the nourishment strike in the soil below, and spread between the rows wherever they meet with a loose and mellow earth.

In order to have a heavy crop, especially of Swedish turnips, or *rutabaga*, it is advisable to sow the seed early, that is, in the beginning or middle of May. They will then have the advantage of the summer showers, and be beyond the reach of the fly in a very few days, and when the dry weather sets in they will already have a supply of moisture in their roots, and the fibres, having struck deep, will not suffer any check. The only inconvenience of sowing early is that many of the plants are apt to run to seed. This is in many cases owing to the seed which is used. If the seed has been raised from fine roots which have stood the winter, there is little danger of the plants running to seed in the first summer; but, as is often the case, if small imperfect roots are taken, or those which run to seed in autumn, then the plants will have a tendency to produce seed and not bulbs. The white Norfolk turnip and its varieties should be sown about midsummer to have a good and heavy crop before winter. The distance at which they may be left in thinning them out must depend on the variety, whether it has a wide spreading top or not. The best crops both of swedes and common field turnips are generally those where the tops are vigorous and moderately spreading. A small top will not nourish a large bulb: but when the growth is chiefly in the leaves, the bulbs are seldom large.

It may be considered as a general rule, that the most advantageous mode of consuming turnips is to draw them and cut them in slices in the field, to be there consumed in troughs by sheep, to whom corn or oil-cake, as well as hay, is regularly given. When the crop of turnips is abundant, part of them may be stored for the cattle in the yards or fatting-stalls, and for the milch-cows and heifers. They will require nothing but good straw, if they have plenty of turnips, and no hay whatever need be used, unless it be for the horses; and even they will thrive well on Swedish turnips and straw with a small quantity of oats. Turnips are often left in the field all the winter, which greatly deteriorates them. If they cannot all be fed off before Christmas, they should be taken up, with the tops on and set close together, covered with the tops on a piece of grass or in some dry spot. They will thus be quite sufficiently protected from the frost: or the tops may be cut off within an inch of the crown of the root, and they may be stored in long clamps five feet wide and four feet high, sloped like the roof of a house and covered with straw and earth, in which state they will keep till they are wanted. It is advantageous to have different varieties of turnips, which will come to perfection in succession; and it is useful to sow some at different times for this purpose. The small turnip, which from its rapid growth is called the nimble turnip, may be sown as late as the end of August, and in mild seasons will produce tolerable bulbs in winter and early in spring. The frost will not injure a growing turnip so readily as one which is come to perfection and the leaves of which are withered. Some varieties, like the yellow Aberdeen and the green round turnip, are hardier than others, and will stand the winter well in a light and dry soil.

There are so many varieties cultivated, that it is difficult to enumerate them. The Swedish turnips may be classed according to the colour and size of their tops and the shape of the bulb. The best have but little stem rising from the bulb and a good tuft of leaves. The substance of the turnips is of a bright yellow and has a strong smell, especially when they have been kept some time. No frost will hurt them, if they are kept dry; but alternate rain and frost will do them harm. When they are stored, it is advantageous that the air should have free access; and for this purpose it has been recommended to place them between hurdles set upright and to slightly thatch them with straw to keep out the rain. In this way they keep longer sound than when put in clamps covered with straw and earth.

Of the field turnip there are numerous varieties. The common Norfolk turnip is round and flât, the bulb being half buried in the ground; it throws out no fibres, except from the slender root which proceeds from the centre of the bulb. There is a subvariety which is reddish at the insertion of the leaves, and another of a green hue: the latter is the hardiest. The globe turnip takes its name from its shape; it rises more out of the ground, and grows to a greater size; like the last it is either entirely white or red or green near the crown. It is on the whole the most productive and hardy. The tankard turnip rises high out of the ground, and approaches in shape to the mangel wurzel. It grows to the greatest size; but it is apt to become spongy if left long on the ground, and its weight is not in proportion to its bulk. There are red tankards and green tankards, as well as white. The green round turnip is considered very hardy, and is usually sown late, to be consumed after the winter. The yellow Aberdeen, although somewhat less, is compact, and stands the winter well: it is a very useful variety.

Next to those above mentioned come the smaller turnips of quicker growth, which have mostly been taken from the garden. They should not be sown early, as they are very apt to run to seed in dry weather; but in a moist climate they may be sown at any time in the summer, and they will be in perfection in three months. Thus they may be made to fill up the interval between the early rye or Trifolium, fed off in spring, and the wheat sown in autumn.

Those who are possessed of a good variety will do well to raise their own seed, as that which is bought cannot always be depended upon for this purpose; the best-shaped middle-sized bulbs should be chosen, the leaves being cut off not nearer than an inch from the crown. They should be planted in a mellow soil, in rows three feet wide, and a foot from bulb to bulb in the rows, about March or April. When the pods are well filled with seeds, and these are round and hard, the stem should be cut close to the root and carefully laid under a shed to dry. The seed will ripen there without shedding, and when the pods are quite dry, the seed is easily beat out with a stick or light flail. Birds are so fond of it, that a constant watch must be kept, and this is the reason why so few farmers grow their own seed. Turnip-seed is often raised in the gardens of cottagers, whose children keep off the birds, and it is a branch of industry which every farmer should encourage. He can readily see that good bulbs only are used, and he secures the seeds he wants, while the cottager is well paid for his trouble. This is perhaps the most convenient mode of raising the seed on a large farm. If the seed is kept in a dry granary, it will be good for several years. It is however best to use fresh seed, as it always germinates sooner. The seed is seldom steeped, but generally drilled in the rows by a drill-barrow or more perfect sowing-machine. The best farmers, even on land well manured and in good heart, sow with the seed some artificial manure, as bones, rape-cake, or rich dried compost, to accelerate the first growth of the plants. Machines which sow the seed and manure in drills at the same time may be had of most of the manufacturers of improved agricultural implements.

TURNIX. [PERDICIDÆ, vol. xvii., p. 442.]

TURNPIKE ROADS. [ROADS.]

TURNPIKE TRUSTS. Turnpike-roads are a peculiar species of highways placed by the authority of Acts of Parliament under the management of trustees or commissioners, who are invested with certain powers for the construction, management, and repair of such roads.

Besides the various local acts, there are several Acts of Parliament called General Turnpike Acts, the provisions of which extend and apply to all existing and subsequent local acts. The subsisting enactments upon this subject are contained in 3 Geo. IV., c. 126, which repeals former General Turnpike Acts; 4 Geo. IV., c. 16, c. 35, c. 95; 5 Geo. IV., c. 69, 7 & 8 Geo. IV., c. 24; 9 Geo. IV., c. 77; 1 & 2 Wm. IV., c. 25; 2 & 3 Wm. IV., c. 124; 3 & 4 Wm. IV., c. 80; 4 & 5 Wm. IV., c. 81; and 5 & 6 Wm. IV., c. 18, c. 62. The General Highway Act (5 & 6 Wm. IV., c. 50) also contains certain provisions applicable to turnpike-roads; but, by the 113th section, does not extend to them except where expressly mentioned.

The trustees of turnpike-roads consist of persons nominated for that purpose in the Local Acts, who must be persons possessed of a certain property qualification, and of the justices of peace of the county or counties through which the roads pass; but all persons who are contractors or otherwise personally interested in the roads are disqualified from being trustees. (3 Geo. IV., c. 126, ss. 61, 62. *et seq.*) They are exempt from personal liability for acts done in pursuance of their powers, and may sue and be sued in the name of their clerk. (7 & 8 Geo. IV., c. 24, ss. 2 & 3; 3 Geo. IV., c. 126, s. 74.)

Every local turnpike act contains a reference to a plan of the road intended to be made, altered, or repaired; and by the general turnpike acts the trustees of any such roads are empowered to make, divert, alter, improve, and fence roads, to carry them through private or waste grounds, so as the road shall not exceed 60 feet in breadth, and to make compensation to the owners; but in so doing they are not to pull down dwelling-houses or buildings, or to deviate more than 100 yards from the plan under the local act, or to take gardens, &c., without the consent of the owners. Trustees are also enabled to purchase lands for the use of the roads; and for these purposes the acts contain various clauses providing for the cases of contracts with persons incapacitated, of persons refusing to treat, of doubtful or disputed titles, and of lands subject to mortgage. They are also empowered, on the completion of new roads, to stop up old ones, and to sell the land and soil of them, or any other lands or tenements not wanted for the purposes of the roads. (3 Geo. IV., c. 126, ss. 84, 85, 86, 87, 88, 89, 111, 112; 4 Geo. IV., c. 95, ss. 55, 63, 65, 69; 7 and 8 Geo. IV., c. 24, ss. 7, 8, 9, 10, 11, 12, 13, 14, 15, 18; and 9 Geo. IV., c. 77, s. 9.) Thus it appears that while in the case of other highways the property in the soil is in general in the owner of the adjoining land, subject to the use of it as a public way (2 *Inst.*, 705), in the case of turnpike-roads the fee-simple of the road is vested in the trustees.

For the purpose of providing the necessary funds for making and maintaining the roads under their charge, trustees are usually empowered to receive monies by way of subscription, upon which interest is payable to the subscribers out of the produce of the tolls which the trustees are by the local acts empowered to levy upon persons using the roads. Power is also given them to borrow money upon mortgage of the tolls. (3 Geo. IV., c. 126, s. 81.)

Under the common law, whenever a highway was out of repair, the inhabitants of the parish were bound, by actual labour thereon, to reinstate it in good order. Under the Highway Acts, officers were appointed for the superintendence and management of highways, actual labour was allowed to be compounded for in money, and a power was given to raise funds by assessment for effecting repairs or improvements. By the conversion of highways into turnpike-roads the management of them is, as above stated, transferred to trustees, with peculiar powers to raise money for their maintenance; but it is not true, as has sometimes been supposed, that turnpike acts have the effect of relieving parishes and townships from the common-law liability to repair the highways. 'The obligation to maintain all public roads (with the exception of those which are to be repaired *ratione tenuræ*, or *clausuræ*) is a public burden, and in the nature of a public tax. The repairing by parishes and townships of some part, and by counties of other parts, are merely modes which the law has provided for discharging that obligation. It is their share of the public burden which those districts have to pay, and which is imposed for the benefit of the community; and tolls are an additional tax for the same purpose.' (4 B. and Adol., 109.)

The enactments of the General Highway Act (5 & 6 Wm. IV., c. 50, s. 94), relating to summary proceedings before justices to compel repairs of highways, expressly extend the jurisdiction of the justices to turnpike officers, where the highway out of repair is part of a turnpike-road; and while the liability to statute labour existed, it was exigible as well in respect of turnpike-roads as other highways; but the obligation of statute labour seems to be now entirely abolished by the repeal, in the 5 & 6 Wm. IV., c. 50, of the statutes under which statute labour was compounded for. By the 3 Geo. IV., c. 126, s. 110, it is enacted that when a parish is indicted for non-repair of a turnpike-road, the court is to apportion the fine between the parish and the trustees, provided it can be done without endangering the securities of the creditors who have advanced money on the credit of the tolls.

Trustees of turnpike-roads have power to enter into contracts for the making, alteration, and repair of roads, bridges, &c., and also to compound with persons or corporations liable by tenure or otherwise to the repair of any such roads or bridges; it being provided however that any alterations or improvements made in such roads or bridges are not to affect the previous liability of those parties to repair. (3 Geo. IV., c. 126, ss. 106, 108; 4 Geo. IV., c. 95, ss. 68, 78; & 7 & 8 Geo. IV., c. 24, s. 17.) Certain powers are also given to trustees to take from the beds of rivers, common or waste lands, and also from lands belonging to individuals, upon giving satisfaction for damage, materials for the making and repair of roads. (3 Geo. IV., c. 126, s. 97, *et seq.*)

The amounts of toll exigible on any turnpike-road are regulated by the table of tolls which is contained in the local act by which the trust is constituted, and no tolls can be charged except such as are given by clear and unambiguous language in the Act. Under the General Turnpike Acts no toll can be demanded for horses or carriages attending her Majesty or the royal family, or for horses or cattle carrying materials for roads and bridges, or manure (except lime, where a toll on it is authorized by the local Act), or agricultural produce not sold or for sale, or for horses or cattle going to or from plough, pasture, watering, or being shoed, &c., or from persons going to or returning from church, or from inhabitants of a parish through which the road passes attending funerals of persons dying and being buried within the parish, or from ministers attending their parochial duty, or for the conveyance of vagrants or of the mails, or for the horses of officers and soldiers on duty, or for the conveyance of their baggage, or of sick or wounded officers or soldiers, or of ordnance or public stores, or for horses and carriages used by yeomanry or volunteers upon duty, or employed in conveying persons to or from county elections, or for horses and carriages merely crossing turnpike-roads and not proceeding more than 100 yards thereon. There are certain exceptions to these exemptions, with respect to gates within five miles of London. Penalties not exceeding 5*l.* are imposed on persons fraudulently taking the benefit of any exemption. (3 Geo. IV., c. 1, ss. 26, 27, 28, 32, 33, 36; 4 Geo. IV., c. 95, ss. 23, 24, 26; 9 Geo. IV., 77, s. 17; 1 & 2 Wm. IV., c. 25, ss. 1, 3, 4; & 5 & 6 Wm. IV., c. 18, ss. 1 & 2.)

Tolls upon turnpike-roads are always made payable once a day only at any one gate, and payment at one gate generally gives exemption from payment at other gates within a certain distance. Post-horses having passed through any gate may return toll-free before nine o'clock in the morning of the following day, and when horses, having passed through a gate, return the same day or within eight hours, drawing a carriage, the toll paid on the horses is to be deducted. (3 Geo. IV., c. 126, ss. 29, 30.) Many cases have occurred upon disputed liability to payment of toll more than once a-day. These have mostly arisen upon the wording of the clauses in the local Acts imposing the tolls; some laying them on the carriages and some upon the horses. (2 Brod. & Bing., 30; 3 Bing., 41; 2 B. & C., 515; 4 B. & C., 200; & 5 B. & C., 31.) The rules to be deduced from them appear to be that, when the toll is imposed upon *carriages* drawn by horses, and there is a clause of exemption for persons repassing on the same day with the same horses *and* carriage, or with the same horses *or* carriage, and the same carriage returns on the same day, drawn by different horses, then no second toll is payable. And when the toll is imposed upon the *horses* drawing the carriage, with a similar clause of exemption, no second toll is payable if the same horses return with a different carriage. It is frequently provided that toll shall be payable again when a carriage returns with a new loading, and that hired carriages shall pay on every new hiring; but in a case where a local Act imposed a toll upon carriages drawn by so many horses, and so much on every horse, and exempted any person from the payment of toll more than once a day for passing or repassing with the same horse or carriage, and another clause provided 'that in all carriages travelling for hire, the traveller or passenger conveyed therein should be considered as the person paying the toll, and that such payment should not exempt such carriages passing with a different traveller, it was decided that this latter clause did not extend to stage-coaches, the carriage itself not being hired, but only a conveyance by it. (10 East, 66.)

The General Turnpike Acts contain various provisions regulating the weights to be allowed to carriages passing along turnpike-roads, and imposing additional tolls for overweight, and also provisions regulating the amount of toll leviable upon waggons and carts, depending upon the construction, breadth, and tire of their wheels. (3 Geo. IV., ss. 7, 9, *et seq.*; 4 Geo. IV., c. 95, ss. 2, 5, *et seq.*)

Trustees are enabled to erect toll-gates and toll-houses, the property in which is vested in them, and are required to put up at every toll-gate a table of the tolls leviable thereat, and to provide tickets denoting payment of toll to be delivered to persons paying the same. (9 Geo. IV., c. 77, s. 3, *et seq.*; 3 Geo. IV., c. 126, ss. 37, 60; & 4 Geo. IV., c. 95, s. 28.) As to the remedies provided for the recovery of tolls, and the penalties for evading them, see 3 Geo. IV., c. 126, s. 39, *et seq.*

The trustees of every turnpike-road have power to enter into compositions for any term not exceeding a year at a time, with any person or persons for tolls payable at any toll-gates under their management. (4 Geo. IV., c. 95, s. 13 They may also, even though not empowered to do so by the local act, reduce the tolls leviable under the authority of the act, and advance them again to any amount not exceeding the rates authorised by the act; provided that where money has been borrowed on the credit of the tolls, no reduction shall be made without the consent of the persons entitled to five-sixths of the money due. (3 Geo. IV., c. 126, ss. 43, 44.) Trustees may also farm out the tolls, though no express power be given in the local act, for any term not exceeding three years at a time. (3 Geo. IV., c. 126, ss. 55, 57, 58; 4 Geo. IV., c. 95, s. 52, *et seq.*)

The General Turnpike Acts contain numerous provisions with respect to the appointment and duties of officers, the meetings and proceedings of trustees, the making of causeways, ditches, and drains, the erection of milestones, the watering of roads, the prevention and removal of annoyances and nuisances, the marking of carriages and regulations as to drivers, the apprehension of offenders, the recovery and application of penalties, the limitation of actions, &c.; all which general enactments have been made from time to time for the purpose of shortening and lessening the expense of private road bills, so that almost the only objects which now require to be attended to in forming road acts are the appointment of trustees, the number and situations of toll-gates, and the amounts of tolls.

(Wellbeloved, *On Highways*; Burn's *Justice of the Peace*, by D'Oyly and Williams, art. 'Highways (Turnpike)'.)

TURNSOLE. [ARCHIL.]

TURNSTONE. [SCOLOPACIDÆ, vol. xxi., p. 86.]

TURPENTINE TREE, the name given to some of the species of trees belonging to the genus Pistacia. The genus Pistacia belongs to the natural order Anacardiaceæ, and is known by the possession of diœcious flowers, which are without petals. In the male plants they are disposed in racemes resembling catkins, and each flower is accompanied with a bractlike scale; the calyx is 5-cleft; the stamens are 5; and the anthers are 4-cornered. The female flowers are disposed in less dense racemes than the male: the calyx is 3-4-cleft; the ovary is 1-3-celled; stigmas 3; and fruit a dry ovate drupe, having one cell containing a single seed; two of the cells of the ovary are sometimes found abortive.

The Venetian Turpentine-Tree, or Turpentine Pistachia-Tree (*P. terebinthus*), is a tree growing to the height of 30 feet. It has deciduous unequally pinnate leaves, of about 7 leaflets, which are ovato-lanceolate, rounded at the base, and acute and mucronate at the tip. The fruit is round, not succulent, and somewhat furrowed, and when ripe of a dark blue colour. Its leaves and flowers emit a very heavy resinous odour. This tree is a native of the south of Europe and the north of Africa, and was introduced into this country about 1656: it is not however common. One of the finest specimens in Great Britain is growing in the Chelsea Botanic Garden. The Chian or Cyprus turpentine is procured from the *Pistacia terebinthus*. This turpentine is more costly than other kinds, on account of the small quantity obtained. A tree of 50 or 60 years' growth does not yield more than 10 or 12 ounces annually. The turpentine is procured by making incisions into the branches, from which it oozes in a fluid state, and is then allowed to concrete for a few days, after which it is collected. This species of Pistacia is liable to the attacks of a cynips, producing horn-shaped excrescences. These were figured and described by Gerard, in his 'Herbal,' in speaking of which he says, 'This plant beareth an empty cod or crooked horne, somewhat reddish, wherein are found small flies, worms, or gnats, bred and engendered of a certain humorous matter, which cleaveth to the inner sides of the said cods or hornes, which wormes have no physicall use at all.'

The Mount-Atlas Mastich, or Turpentine-Tree (*P. atlantica*), is a deciduous tree, growing in Barbary, not far from Mount Atlas. It is also, with the last species, found in the island of Scio (Chios) and about Constantinople. When cut into, it yields a large quantity of resinous matter, very much resembling mastich. The Arabs use it for chewing, to give whiteness to their teeth. The Moors eat the fruit as they do that of the date.

The Mastich-tree (*P. Lentiscus*) is evergreen, and has abruptly pinnate leaves, with 8 lanceolate leaflets, and a winged petiole. This tree attains a height of about 20 feet, and is a native of the coasts of the Mediterranean. It yields the mastich of commerce, and is a handsome tree. It was introduced into British gardens about 1654, but it does not bear this climate so well as the P. terebinthus.

The Pistacia-Nut Tree (*P. vera*) has deciduous, unequally pinnate leaves, composed of from 3 to 5 ovate leaflets, which taper a little at the base, and are indistinctly mucronate at the tip. This tree attains a height of about 20 feet, and is a native of Syria. It yields the pistacia-nut [PISTACIA NUT], and for this purpose it is cultivated in the south of France and Italy. It was introduced into British gardens in 1770. It will grow as a standard, but it is best placed against a wall. It will produce fruit in this country, but the nuts do not ripen.

TURPENTINES. A large number of substances are embraced under this designation, which has always been applied to certain of them, while others, which were formerly by scientific writers, and are even still by the community, termed *balsams*, have been referred to this head, their claim to be regarded as balsams being abandoned, as they are devoid of benzoic acid. Some of these, such as copaiba, are oleo-resins, many of which have been already treated of under the name of the plant which produced them: there remain to be treated of here those oleo-resins which are derived almost exclusively from the tribes of plants called the *Coniferæ*, or Pinaceæ (fir-tribe), and the *Terebintaceæ*, or that section of it termed Anacardiaceæ. Several articles yielded naturally, or procured by some artificial process from the first of these, have been described. [CREASOTE; FRANKINCENSE; OILS; SANDARAC; TAR.] A short notice of the others are here given, commencing with the products of the fir-tribe.

The Coniferæ yield a variety of terebinthinate articles to the Materia Medica. Exclusive of those from the genus Juniperus [GENEVA], the others are obtained from the genera Pinus, Abies, Picea, and Larix. It is difficult to indicate which of the species of these genera furnish the diversified products known under the designations of turpentines and resins. Few tribes of plants are more valuable to mankind in every respect save that of food; yet even this is not wanting, as the bark of the P. sylvestris is formed in years of scarcity by the Norwegians into bread, and the P. pinea, or stone pine, produces seeds, denominated *nuclei pineoli*, which in France and Italy are used at dessert, and even in the time of Pliny were preserved in honey, a custom continued in Spain to the present time, the sweetmeat called turonne being a mixture of honey and the seeds of this pine. It is heavy and indigestible, and should be used very sparingly.

In the Pharmocopœia the P. sylvestris is stated to be the source of the common turpentine (Terebinthina vulgaris), and is unquestionably the source of the coarsest sort. The mode of obtaining it is thus described by Loudon, in the 'Arboretum Britannicum,' p. 2174.

'To procure it, a narrow piece of bark is stripped off the trunk of the tree in spring, when the sap is in motion, and a notch is cut in the tree, at the bottom of the channel formed by removing the bark, to receive the resinous juice, which will run freely down to it. As it runs down, it leaves a white matter like cream, but a little thicker, which is very different from all the kinds of resin and turpentine in use, and which is generally sold to be used in the making of flambeaux, instead of white bees'-wax. The matter that is received in the hole at the bottom is taken up with ladles and put into a large basket; a great part of this immediately runs through, and this is the common turpentine. It is received into stone or earthen pots, and is then ready for sale. The thicker matter which remains in the basket is put into a common alembic; and a large quantity of water being added, the liquor is distilled as long as any oil is seen swimming upon the water. The oil, which is produced in large quantities, is then separated from the water, and is the common oil or spirit of turpentine. The remaining matter at the bottom of the still is the common yellow resin.'

Pix liquida, tar, is obtained by the dry or destructive distillation of several woods, such as beech and pines: but is chiefly got from the residual mass after the distillation of wood to procure pyroligneous acid (wood vinegar). When obtained from fir-trees, it comes over at first as a brownish yellow oily liquid, called Pix liquida alba; while from other trees it is a thick, oily, blackish brown liquid, heavier than water, with a disagreeable empyreumatic odour, and a nauseous, acrid, bitter, empyreumatic taste, which endures a long time. It is inflammable, burning with a bright flame and much smoke. It is a mixture of creasote, picamar, parafine, eupione, acetic acid, and other products of dry distillation not accurately ascertained. The tar from pine-trees also contains oil of turpentine, while creasote is chiefly found in beech-tar, scarcely ever in pine-tar.

Tar is little fitted for internal use, and pitch is generally substituted for it. Tar diffused through water for some time communicates its odour to it, and gives it an amber-like colour. This has been much vaunted as a remedy in pulmonary consumption. The introduction of it has been attributed to Bishop Berkeley, but it was recommended even by the Roman physicians: it has nearly lost its character, especially since the isolation of creasote. An oil distilled from tar is sometimes confounded with creasote, as it is likewise incorrectly termed oil of tar. Oil of tar is beneficially applied to ringworm and other diseases of the scalp. Tar ointment is very efficacious in similar affections. Equal parts of tar and sulphur ointments will generally cure porrigo favosa in a fortnight, but they have little influence over porrigo scutellata, for which creasote ointment is nearly a specific.

Pix nigra, pitch, is procured by the evaporation or dry distillation of tar, of which it is the residuum, and its composition is the same, except from the absence of the volatile parts. This in the form of pills is of singular efficacy in some cutaneous diseases, especially of the order squamæ, such as icthyosis. The ointment is also useful in diseases of the scalp.

Abies Balsamea, Poiret; Pinus Balsamea, Linn.; Abies Balsamifera, Michaux, the Balm of Gilead, or American Silver Fir, differs in several respects from the other firs, inasmuch as it seldom grows to a greater height than 20 or 30 feet, and yields a much finer turpentine, resembling some of the oleo-resins of the Terebintaceæ, and designated Canada Balsam.

This juice exudes either spontaneously, when it is of remarkable purity, and then called spurious Balm of Gilead (the genuine is from Balsamodendron gileadense), or false Balsam of Mecca, or by incision. That which exudes spontaneously is most fragrant and transparent; this last property fits it best for optical purposes, such as preserving small objects for inspection under the microscope.

In warm weather, especially from the older trees, it exudes spontaneously, but it is procured more abundantly by incisions of the wood. It has the consistence of recent honey, and is nearly colourless, or only slightly yellowish, pellucid, tenacious, glutinous, thickening with age, till at last it becomes hard. Odour agreeably balsamic, resembling turpentine. Taste somewhat acrid and bitterish.

Like all true resins, it is soluble in alcohol, æther, the volatile and fixed oils. In composition it is an oleo-resin. According to Bonastre, 100 parts contain—

Volatile oil	18·6
A resin easily soluble in alcohol	40·0
A subresin of difficult solubility	33·4
Some fibrous caoutchouc, like subresin	4·0
Acetic acid (traces and bitter extractive) and salts	4·0—100·0

On account of the volatility of the essential oil, and to prevent the hardening of the turpentine, it is necessary to keep it in very well-closed vessels.

An inferior article, chiefly Venice turpentine, is frequently substituted for it. Its action is irritant and diuretic, and it is occasionally used in the same way as copaiba, both in affections of the urinary organs and in diseases of the chest.

Abies canadensis, or Hemlock Spruce, is said to yield a similar juice. The young twigs put in beer, instead of hops, form spruce beer; boiled, they make essence of spruce, both of which are of much utility in preventing sea-scurvy.

The juices of all the species of Coniferæ previously mentioned are oleo-resins, differing from each other chiefly in the relative proportions of oil and resin, being, when the former predominates, more fluid; when the latter, more solid. A spontaneous separation often occurs by the volatilization of a portion of the oil, and the rest absorbing oxygen, an oxide of oil of turpentine is formed, commonly termed resin.

Those which contain most volatile oil possess the greatest power over the system, and the oil when separated still greater.

Common turpentine, or Resina liquida (Terebinthina vulgaris), as the natural combination is termed, yields two distinct articles to the Materia Medica, viz.: 1, Oleum terebinthinæ, obtained by the distillation of the liquid resin; 2, Resina, or simply resin or rosin, which is resin with a little water, remaining after nearly all the oil has been distilled off: but if the process of distillation be carried as far as possible without causing new combinations of the elements, all the water is driven off, and the residuum becomes black, and is termed Colophony, and sometimes fiddler's rosin. The resin is used merely to make cerates, ointments, and plasters, which are more or less stimulant.

As turpentines have a very disagreeable taste, it is customary to form them into pills or boluses; but since this is rather difficult, it is well to be aware that magnesia affords a convenient means of accomplishing it, as in the case of the oleo-resin of copaiba. The kind of magnesia and the quantity to be used vary in the different kinds of turpentine. Bourdeaux turpentine (from P. maritima, or P. pinaster) requires one twenty-one part of magnesia usta to form a pill-mass. Venice turpentine (from Larix Europæa), called also turpentine of Briançon, requires a quantity equal to its own weight of carbonate of magnesia to form a pill-mass. But the quantity of magnesia must vary with the age of the turpentine, more being required when it is very fresh than when the turpentine is old and more solid. The durability of the mass also varies with the proportion of magnesia used.

One ounce of Venice turpentine united with one ounce of hydrated carbonate of magnesia, formed a mass which was slow of consolidating, and the pills soon lost their globular form: but three ounces of the magnesia formed a persistent mass. One ounce of turpentine and one ounce of Bourdeaux turpentine, with six drachms one scruple of carbonate of magnesia, furnished a slowly hardening mass, which at last resolved itself into powder; while one ounce of the same turpentine with eight grains of magnesia formed a soft mass, which, after thirty-six hours, was sufficiently consistent to form pills. Some days afterwards it became harder, and did not for a long space become friable. With a yet smaller quantity of magnesia these changes take place more slowly, so that it is requisite in magistral formulæ never to order less magnesia than the one-fiftieth part of the turpentine. This proportion forms in a few minutes a transparent pill-mass with a vitreous fracture. But the finer sorts of turpentine may be administered in the liquid form; the coarser must be in pills.

Oleum Terebinthinæ, Oil or Spirits of Turpentine, as it occurs in commerce is never pure, but contains more or less resin formed by the action of the air; and to obtain it pure, it is ordered to be distilled a second time, and then called Oleum Terebenthinæ purificatum, and sometimes Oleum Pini purissimum. The commercial oil of turpentine has an acid reaction, the purified has not. The impure has always from 4 to 5 per cent. of oxygen, owing, according to Dumas, to some water remaining diffused through it.

When pure, it is colourless, limpid, very fluid, and possessing a penetrating disagreeable odour. That which is distilled from the Strasbourg turpentine, procured from Abies Picea, or silver-fir, is much less unpleasant, and at a distance resembles oil of citron or lemon.

Its specific gravity at 70° Fahr. varies from 0·85 to 0·89. It boils at 312° Fahr., but by addition of water it boils at nearly 212°, at which temperature it may be readily distilled. It is one of the volatile oils which is devoid of oxygen, but its exact chemical nature is not determined. It consists of from 87·51 to 88·43 of carbon, and 11·33 to 11·36 hydrogen: its atomic constitution, according to Dumas, is—

40 atoms of carbon	88·5
32 atoms of hydrogen	11·5—100

According to Blanchet and Sell, it contains, or is a mixture of, two isomeric oils, dadyl and peucyl; and which, by spontaneous oxygenation, are converted into the two acids which constitute resin and colophony, viz. pinic and sylvic acids: pinic acid is soluble in cold alcohol; and what remains undissolved is sylvic acid. Dadyl combines with hydrochloric acid, and forms a hydrochlorate of essence of turpentine, called also artificial camphor. This principle, or dadyl, is called, by Dumas, Camphogen.

Oil of turpentine is insoluble in water, yet it communicates its odour to it: also it can be united with water, forming a hydrate (or stearopten) which crystallizes in colourless prisms, shining, pellucid, inodorous, and insipid: it is composed of 1 atom of oil and 6 atoms of water. Oil of turpentine is soluble in highly-rectified spirit of wine to the extent of 10 per cent. In absolute alcohol, æthers, and oils, it may be mixed in any proportion. When long and repeatedly agitated with alcohol, it loses its odour, which after a time it again recovers. It is most thoroughly purified by digestion on animal charcoal. Oil of turpentine possesses the property of dissolving phosphorus. When formed into an emulsion it not unfrequently happens that these coagulate, which is owing to the presence in the oil of some free acetic acid or benzoic acid. Oil of turpentine taken internally communicates to the urine an odour of violets.

Oil of turpentine is one of the most energetic of the volatile oils: the vapour is quickly destructive to plants, and in large doses it acts as a poison to both vertebrate and invertebrate animals. Like all volatile oils it acts powerfully on insects which respire by the whole surface, hence it instantly kills wasps, lice, fleas, and worms. It has a more potent action on the lower animals than on man, both externally and internally. Applied to the skin of horses, it blisters it more rapidly than the skin of man; and two drachms administered to a dog (Schubart, in Christison) caused death in three minutes, while human beings have taken 3 ounces without any serious consequences. Indeed Dr. Christison states that he is not aware that it has ever proved fatal. Horses also have taken for some days as much as 10 or 12 ounces. (Moiroud, in Pereira's *Lectures*.)

In moderate doses it acts as a stimulant to the stomach and whole intestinal canal; manifested by a grateful feeling of warmth, with greater activity in the mucous membrane of the intestines, and of the liver. The increasing secretion of these organs, particularly of the bile, causes more frequent evacuations: further, it promotes the secretion of the kidneys, and likewise, but less evidently, of the skin, the pulmonary surface, and also of the uterus. It communicates the terebinthaceous odour to the cutaneous perspiration, and sometimes even causes an eruption on the skin.

Its effect on the vascular system is equally stimulant: Dr. Copland made many experiments on himself, when in health, and found that his pulse became more frequent, small, and contracted; with feelings of intoxication, anxiety, shiverings, a sensation as if the intestines were drawn towards the vertebral column, unpleasant eructations, thirst, and a sharp hunger; sensations which food caused gradually to subside, without vomiting or diarrhœa. Very large doses often produce temporary intoxication, and sometimes a kind of trance, lasting twenty-four hours, without any subsequent bad effect.

Implicit reliance is placed on oil of turpentine against the tape-worm. It is in general recommended to be given in large frequently-repeated doses, mixed with mucilage, syrup, and cinnamon-water, and is thought to directly kill the worm, rather than destroy it by removing the means of its further nourishment. But this mode of administration is by no means so eligible as that of small doses (ʒj to ʒij) per diem for a continuance, a plan recommended by Vogt (*Pharmacodyn.*, vol. ii., p. 163), and proved by Dr. Graves to be effectual.

In chronic affections of the liver, obstructions from gallstones, &c., if no inflammatory state be present or approaching, oil of turpentine with twice its weight of spirit. æther. sulphur. in the dose of from 10 to 20 drops, in yolk of egg, is often very useful; in melaena and obstructions of the liver, and vena porta, &c. It is most likely, from its action on the liver, that it proves serviceable in chronic rheumatism. In sciatica, Dr. Cheyne recommends it in small doses. It is useful in atony of the intestines, lacteals, particularly of old and phlegmatic people, especially of the lower orders. Even typhus fever, if there be a tympanitic state of the abdomen, is benefited by it, and Dr. Chapman has found it valuable in the yellow fever of Philadelphia. Dose from 1 to 2 drachms per diem. In cholera asiatica, with spirits of ammonia. In obstinate constipation, in large doses. In scarlet fever, when the eruption does not come freely out, 10 to 60 drops in one to three tea-spoonsful of castor-oil. (Dr. Delany of Georgia, U. S.) In chronic cramps, convulsions, and epilepsy (with only temporary benefit). In atony of the kidneys and bladder. In catarrhus vesicæ, gleet, gonorrhœa, and leucorrhœa, it may often be advantageously substituted for copaiba. In atonic hæmorrhages it is very useful. In puerperal peritonitis, applied externally, it is of great utility. Externally in burns, the linimentum terebinthinæ, or hot dressing, is useful. In peritonitis with a tympanitic condition of the abdomen it is very excellent.

Oil of turpentine at a high temperature readily ignites, and burns with a fierce, dense, red flame, and much black smoke. This readiness to ignite and the copious evolution of smoke are easily explained by reference to its chemical composition. Consisting of a very large proportion of carbon, with some hydrogen, but no oxygen, it only requires an elevated temperature, such as the proximity of a burning body, to cause it to rush into a state of combustion in order to saturate the large quantity of carbon with oxygen. This property renders it valuable to enable a number of candles to be lighted readily, as in candelabras in public rooms, by merely immersing the end of the wick in oil of turpentine. The copious fumes of smoke render oil of turpentine an unpleasant article of combustion in private houses; but this objection may be completely obviated by submitting the oil to rectification, and burning it in flat-wicked lamps, by which a much larger quantity of oxygen is brought in contact with the particles of carbon, and thus little or no smoke is formed. This is done with the lamp naphtha, which is merely purified oil of turpentine.

The only article yielded by the Terebintaceæ which remains to be treated of here is Chian turpentine, as the genuine Thus, or Frankincense, has been already noticed. [Olibanum.] Chian or Cyprus turpentine, called also true turpentine, is obtained from the Pistacia terebinthus. [Turpentine Tree.] This tree is a native of Barbary, Syria, the south of France, and, above all, of the Grecian Archipelago. The juice exudes naturally, but in very small quantity; and to procure it in greater abundance the inhabitants of Chio make in the stems and branches transverse incisions. Eight or ten ounces are the utmost obtained from one tree; hence it is very dear. It is of the consistence of new honey, tenacious, pellucid, of a light yellowish-green colour. The odour is penetrating and peculiar. It has a slightly bitter taste; but when adulterated with any of the coniferous kinds, its odour is strong, its taste acrid, and of a sensible degree of bitterness. It consists of a volatile oil and resin, and when by time the former is dissipated or oxydized, it becomes hard and translucent. This article is scarce in a pure state, it being mixed largely, with Venice turpentine, and indeed in many instances altogether supplanted by that article. It was greatly esteemed by Hippocrates; and in the present day it is chewed by the inhabitants of Turkey, Persia, &c., as mastic is, to sweeten the breath. But it likewise improves the digestion, having a very beneficial influence on the secretions of relaxed mucous membranes. Hence it is useful in chronic catarrh, both of the lungs and genito-urinary organs. For the latter it is advantageously combined with sulphate of zinc.

On certain of the trees, owing probably to the punctures of insects, are produced follicular gall-like bodies, termed *gallæ pistachinæ*, which yield a glutinous juice, and, when smoked like tobacco, are found very serviceable in some cases of asthma. See Th. Martius, *Ueber Gallae Pistachinae*, with figures, in *Annalen der Pharmacie*, Rd. 21, p. 179; also Dierbach, *Die Neuesten Entdeckungen in der Materia Medica*, i., p. 97, and ii., p. 254. They are obtained chiefly out of Dalmatia, and are called Carobe del Legno di Giuda. They appear to be a different article from those found on the leaves from the puncture of the Aphis Pistachiæ, L., in which a considerable trade is carried on in the Levant for the purpose of dyeing silk.

TURPETH MINERAL. [Mercury, xv. 104.]

TURPIN or TILPIN, Latinized TURPI'NUS, was originally a Benedictine monk of the convent of St. Denis near Paris; but Charlemagne raised him, in A.D. 773, to the archbishopric of Rheims. This dignity he held until his death, A.D. 811, or, according to others, 813. There is a Latin romance in verse containing an account of the expedition of Charlemagne into Spain against the Saracens, of his conquest of the country, and of the heroic death of Roland in the vale of Roncesvalles. This poem, which is entitled 'Historia de Vita Caroli Magni et Rolandi,' was formerly ascribed to Archbishop Turpin, as is stated on the title-page of several MSS. But among the many arguments which have been advanced against that opinion, one is sufficient to show its inconsistency. The author of the romance speaks of the death of Charlemagne, although it is an attested fact that Archbishop Turpin died before the emperor. The work was in all probability composed about the end of the eleventh or the beginning of the twelfth century. Whether the name of the author was really Turpin, and thus gave rise to the confusion, or whether it is a mere forgery, for which the circumstances of those times offered many temptations, cannot be decided. Thus much only seems clear, that the writer's object was to exhibit Charlemagne as the model of a hero in combating paganism and the pagans, and thereby to work upon his contemporaries, so as to rouse them to take part in the Crusades. The tendency of the poem is a religious one, and it bears great marks of being the work of a learned monk, especially in the subtle disputes between the heroes, who fight as much with their tongues as with their swords. Notwithstanding all this, the work is of great interest, being one of the earliest poetical productions of the middle ages. It is printed in S. Schardius' and Reuber's collections of 'Scriptores Rerum Germanicarum.' A separate edition was published by Ciampi at Florence, 1822, 8vo., and another in 1823.

(Vossius, *De Historicis Lat.*, p. 298; Bayle, *Dictionnaire Hist. et Crit.*, under 'Turpin.')

TURPIN DE CRISSÉ, LANCELOT, Comte de Crissé, a writer on tactics, of considerable celebrity, the materials for whose biography are, when his reputation is taken into account, astonishingly meagre. He was born in La Beauce, of a noble family, about the year 1715. He entered the army young; obtained a company in 1734, and a regiment of hussars in 1744. He distinguished himself in his charge of colonel in the wars of Italy and Germany, and was promoted to the rank of brigadier-general.

In the midst of a successful career (about 1753?) he astonished his friends by renouncing the world, and commencing a noviciate in the abbey of La Trappe. His flight from that sanctuary of asceticism was as abrupt as his entry into it. Soon after this unsuccessful attempt to make himself a saint, he became a husband, taking in marriage a daughter of the Maréchal de Lavendhal, a lady of literary tastes, called by her contemporaries 'the secretary of the Abbé de Voisenon,' who nominated her his literary executor, an office which, like some literary executors of a later date, she discharged by publishing all the rubbish of his study.

In 1754 Turpin de Crissé made his début as an author by publishing, in conjunction with Castilhon, the 'Amusemens Philosophiques et Litéraires de deux Amis.' The epistle dedicatory to J. J. Rousseau was composed by our author. Rousseau remarked, for his encouragement, that the work was not bad enough to entitle its author to despair of attaining eminence, nor good enough to entitle him to dispense with making a better.

In the same year appeared a more important work by Turpin de Crissé—'The Essay on the Art of War,' upon which his reputation mainly rests. It was translated into German by the express orders of Frederic the Great. Ligonier accepted the dedication of the English translation by Captain Otway; the Essay was also translated into Russian; and notwithstanding the advance made in the theory and practice of war since the time of its publication, it is still regarded as a work of authority. The work is divided into five books. In the first every possible operation of a campaign (with the exception of sieges) is systematically explained; the second treats of the precautions to be observed in attacking the enemy in the field; the third, of cantonments; the fourth, of attacking the enemy in quarters; the fifth, of partisan warfare and the management of light troops.

In 1757 Turpin de Crissé was recalled to active service; in 1761 he was created Maréchal-de-camp; in 1771 he was made a commander of the Order of St. Louis; in 1780 he was raised to the rank of lieutenant-general, and obtained in the following year the appointment of governor of Fort Scarpe at Douai. His name appears in the list of lieutenants-general in 1792. He was one of the emigration, and is supposed to have died in Germany in such obscurity, that both the time and place of his death are unknown. His wife died before him, in the year 1785: it does not appear that they had any family.

Active service did not withdraw his attention from the literature of his profession. M. Weiss (who alone has endeavoured to throw some light on the personal history of Turpin de Crissé) mentions, in the 'Biographie Universelle,' 'Commentaires sur les Mémoires de Montecuculi,' published in 1769; and 'Commentaires sur les Institutions de Végèce,' published in 1770. Neither of these are to be found in the library of the British Museum. M. Weiss says of the former, that Turpin de Crissé confines himself for the most part to the task of explaining his author; of the latter, that the commentator confines himself to the first three books of Vegetius, but throws out many suggestions in his notes, which have been adopted without acknowledgment. The 'Commentaires de César, avec des Notes historiques, critiques, et militaires,' mentioned also by M. Weiss as published in 1785, is a reprint of Clarke's text of the 'Commentaries,' with Wailly's translation (altered in a few places by the Count) in opposite columns, numerous notes, and plans of battles. The military remarks of the editor are the most valuable part of this edition.

The only works of Turpin de Crissé we have seen—the 'Essay on the Art of War,' and the 'Notes on Cæsar'—indicate extensive reading in the author, and a sobriety of judgment for which the story of his entry and retreat from La Trappe scarcely prepares the reader. The value of his writings, as expositions of military theory, may be inferred from the predilection evinced for them by Frederic the Great of Prussia.

TURPI'NIA, a small genus of trees of the natural family of Celastrineæ, named in honour of M. Turpin, a French botanical artist and the author of several papers in the 'Annales du Musée d'Histoire Naturelle.' It is one of the genera common to the West Indies, India, and the neighbourhood of Canton—the Dalrymplea of Dr. Roxburgh having been found not to differ from the Turpinia of Ventenat. The trees have the habit of Staphylea, with opposite, impari-pinnate leaves, and stalked serrated leaflets. The flowers are white, in panicles and polygamo-diœcious. Calyx 5-parted, with coloured margins. Petals 5, inserted in a 10-crenated disk. Styles 3, joined in one. Berry trigonal, 3-celled; cells 2-3-seeded. Turpinia pomifera, the first discovered Indian species, is called *junki-jam* in Silhet, where it bears a yellow roundish fruit of the size of a medlar.

TURQUOISE. *Calaite; Odontalite.*—Occurs in botryoidal or mammillated masses. Colour greenish-blue, of various shades. Fracture conchoidal, rough, and uneven. Commonly opaque; sometimes translucent on the edges. Streak white. Hardness 5·0 to 6·0. Specific gravity 2·8 to 3·0. Occurs in alluvial clay in Persia.

It has been found to consist of—

Phosphoric acid .	30·90
Alumina . .	44·50
Oxide of copper .	3·75
Oxide of iron . .	1·80
Water . . .	19·00
	99·95

The *Occidental Turquoise*, found near Simon in Lower Languedoc, is stated to be merely bone coloured by phosphate of iron. According to La Grange, it consists of—

Phosphate of lime . .	80
Carbonate of lime . .	8
Phosphate of iron . .	2
Phosphate of magnesia	2
Alumina . . .	1·5
Water	1·6
	95·1

TURRÆA, a genus of plants of the natural family of Meliaceæ, named in honour of an Italian botanist, G. Turra of Padua, who died in 1607. The genus is characterised by having the calyx 5-cleft. Petals 5. Stamens 10, joined into a long tube, 10-cleft at the apex, having the anthers inserted between the lobes. Stigmas thick. Capsule 5-celled, 5-valved, with a partition in the middle of each valve; cells 2-seeded. Leaves simple, occasionally pinnate. Many of the species are highly ornamental, forming trees or shrubs in the interior of the Cape of Good Hope, in Madagascar, the Mauritius, and in the eastern parts of India.

TURRET (from the Latin *turris*) is used as the diminutive of tower (in German, *thürmchen*), but in a peculiar sense, and without reference to positive size, it merely denoting that what is so described is small in comparison with the main structure, of which it forms only a part or single feature. Turrets may be described as of two kinds, such as rise immediately from the ground, and those which are formed on the upper part of a building by being carried up loftier than the rest. Of the first-mentioned kind are staircase turrets, which are generally of very narrow proportions and with small windows. Turrets of this kind were frequently attached to the angle of a larger tower, in which case they usually rise above the latter in order to afford access to its platform roof; owing to which circumstance they serve to contrast with the bulkier mass, and to produce greater play of outline. Thornbury Castle, Gloucestershire, affords a fine example of an octagon tower and a turret of the same plan thus combined. Gatehouse turrets, or such as flank a gateway, belong to the same class.

Turrets which show themselves only on the upper part of a building are either merely carried up higher than the general line of the roof or parapet, or else spring out so as to project and overhang the wall, on which they are supported by corbelling, &c.; and in such cases are sometimes distinguished by the name of Bartizans, or Bartizan-turrets.

In the antient domestic architecture of both France and Scotland, circular towers and turrets with conical roofs are frequent and characteristic features, and sometimes are so numerous, that the whole structure seems to be composed of a cluster of them. Nearly the same may be said of some examples of our Elizabethan style, where groups of turrets, pinnacles, and chimneys produce great picturesqueness of outline. Vanbrugh attempted, not without success, to engraft the same character upon the style he practised, grouping his chimneys together in the form of turrets on the roof, and making them very important, if not exactly the principal features in his compositions.

TURRILITES, De Montfort's name for a genus of testaceous Polythalamacea, occurring in a fossil state in the cretaceous formations. Mr. Sowerby ('Min. Conch.,' vol. i., page 81) gives the generic character thus:—

Shell spiral, turreted, chambered; the turns contiguous, all visible: chambers divided by sinuous septa, pierced in their disks; aperture round.

As far as we know, nearly all the species are sinistrorsal; the septa have generally the sinuosities of ammonites, and the siphuncle is described by Mr. Sowerby as situated near the upper (external) part of the whorls. The cavity beyond the last chamber was very large, as in Nautilus, and probably enclosed the greater part of the animal, so that the shell was *external.* The British species (T. costatus, T. tuberculatus, T. Bergeri, T. undulatus, T. obliquus, of 'Min. Conchology') belong to chalk and green-sand, and these appear to be the strata which enclose the same and other species in France and other countries.

The relations of Turrilites, Scaphites, Baculites, and Hamites to Ammonites are very obvious; and, as through Goniatites this great extinct group is certainly connected to the living and extinct Nautili, Mr. Owen has ventured to include them all in the Tetrabranchiate Cephalopoda [Cephalopoda], leaving Spirula and the Belemnites with Sepia and the Dibranchiate types. However this may be, the determination of the relative affinities among the numerous fossil cephalopods, a point of great importance, must be worked out with the help of other considerations than the respiratory system. Since the article Goniatites was written, fossils of the genus Clymenia, *Munster*, have been described, from Devonshire (Ansted, in 'Cambridge Trans.;' Phillips, in 'Palæozoic Fossils of Devon'); and as baculites are mentioned in the chalk of the south of England, we are furnished by the British strata alone with almost a complete and uninterrupted succession of the testaceous cephalopods of all geological ages. The results of a general survey of these numerous forms in the successive Palæozoic, Mesozoic, and Cainozoic periods, have been presented in the article Polythalamacea, and we shall here add some considerations on the successive forms of the Ammonitidæ, to which by common assent all the genera of chambered cephalopodous shells with sinuous septa are referred. These can hardly be said to appear distinctly in strata below the lias, though the undulated and crenated septa of the Ceratites of the muschelkalk make easy the transition from the angular or undulated septa of the Goniatites and Clymenia to the simply sinuated Ammonites of the lias. [Compare the figures in the articles Goniatites and Polythalamacea.]

The Mesozoic strata are thus seen to be the characteristic, and perhaps exclusive, repository of the Ammonitidæ; and if we suppose them to commence with lias and cease with chalk, the distribution of the several genera will appear thus:—

	Ammonites.	Crioceratites.	Scaphites.	Hamites.	Turrilites.	Baculites.
Chalk formation . . .	*		*	*	*	*
Green sand formation . .	*	*	*	*	*	
Upper oolite formation . .	*	*				
Middle oolite formation . .	*	*				
Lower oolite formation . .	*	* ?	* ?			
Lias	*	* ?				

In the table here presented all species are reckoned Ammonites in which the volutions *touch* each other, and the last chamber, in which the animal was mainly included, forms part of the general spiral. In Crioceratites we rank all species which are convolute at their origin, and whose last chamber runs out in a tangent to the spiral. In some species the whorls *touch*, in others they are detached. (Thus might two genera be defined, the last being the true Crioceratites of Leveille.) In Scaphites are ranked the species partially spiral or incurvated at each extremity. Hamites here includes the siphonoid or hooklike forms figured by Mr. Sowerby. Turrilites comprehends the forms which are spiral round an axis, and Baculites those which are straight.

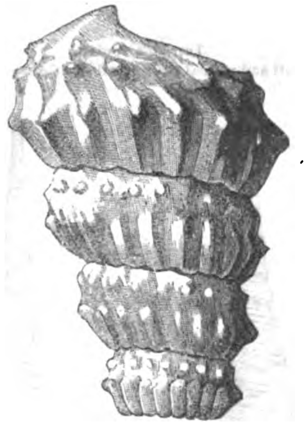
In this point of view the Ammonitidæ with sinuous sutures are paralleled by the Goniatites, Lituites, and Clymeniæ of the Palæozoic rocks; while both Goniatites and Clymeniæ show the last chamber a part of the spiral. Lituites and certain Nautili have it produced straight; and the forms of Phragmoceras recall in some degree those of some Scaphites.

Involute Ammonites, in which the inner whorls are embraced by the outer ones, occur in the lias, and through all the formations into the chalk (Orbulites of Lamarck). Convolute Ammonites, the inner whorls apparent, appear through the same ranges. Evolute forms, such as might be included in Crioceratites, may probably be found less rare, as opportunities of inspecting perfect specimens occur (such as on the railway cutting near Chippenham); Ammonites fimbriatus (Tropæum, Sowerby) may be one of these; Scaphites bifurcatus of Hartmann another; and Hamites spiniger of Ziethen a third. But the greater number appear to be localised in the upper oolitic and green-sand formations, and are specially abundant in the Speeton clay of Yorkshire. The apertures of Goniatites and Ammonites, when perfect, generally exhibit remarkable constrictions and extensions into lateral auricles, and occasionally suggest the notion of variability or even indeterminateness in form, which conducts to Scaphites. (See Goniatites reticulatus, Phillips's 'Geology of Yorkshire;' Ammonites Brakenridgii, A. Brongniartii, &c., in 'Min. Conch.;' and Mr. Pratt on Ammonites, in 'Phil. Mag.,' 1841.)

Scaphites, having revolute instead of straight extensions, differ from Crioceratites, and show a singular difference amongst one another. Scaphites equalis, 'Min. Conch.,' tab. 18 (said to be from Yeovil and also from the green-sand formation, but Yeovil fossils are from the lower oolite), has its extremities coiled in one plane, like an Ammonite. The same is the case with Scaphites Yoannii. But Scaphites obliquus ('Min. Conch.,' tab. 18) has its extremities coiled irregularly round an axis, and thus conducts us easily to Turrilites with its spiral voiutions, and also to Hamites (Sowerby), with its tapering, incurved, but not spiral figure.

Baculites may be viewed as analogous to a straight part of Hamites.

It appears therefore from these considerations that the main differences in these various groups of the Ammonitidæ with sinuous sutures are such as have been also seen in the earlier analogous Palæozoic forms: viz. variations of involution, convolution, evolution, and recurvation—in one plane round a mathematical central point; in an irregular free twist round a short axis; or in a regular spiral round an elongated axis. Evolution, recurvation, rectilinearity, twisting, and spirality round an axis, appear chiefly in the higher strata, among the last terms of this singular series of forms; and these abnormal configurations may perhaps be justly viewed as dependent on an alteration of the physical conditions which allowed of the remarkable abundance of the normal Ammonitic types—while in the total change of those conditions we must look for the cause of the entire suppression of this whole series of organization.



Turrilites costatus.

TURRIS, De Montfort's name for a genus of testaceous gastropods, comprising those species of *Mitra* which have the whorls angulated and the aperture lengthened and undulated.

TURRITELLA. It would be superfluous to state the different positions assigned to this genus by zoologists, some of which will be found in the article Turbinidæ, because the detection of the animal, a description and figure of which will be found below, points out its true place.

Generic Character.—Animal (see the description of *Turritella rosea*).

Shell turriculated, pointed, rather delicate, generally striated in the longitudinal direction of the whorls of the spire, which are numerous; aperture rounded, entire, with the edges of the lip disunited above; the outer or right lip fragile.

Operculum horny, its elements concentric.

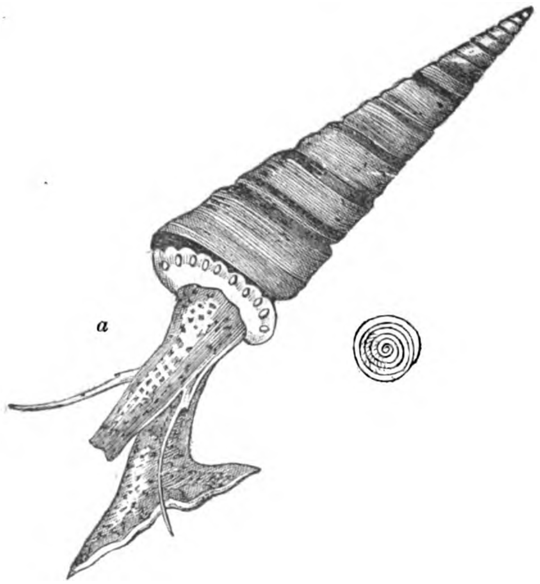
Examples, *Turritella rosea*, Quoy and Gaim.

Description.—Shell elongate-conical, smooth, transversely very slightly furrowed, rosy, the whorls convex; the spire acute; the aperture subquadrate.

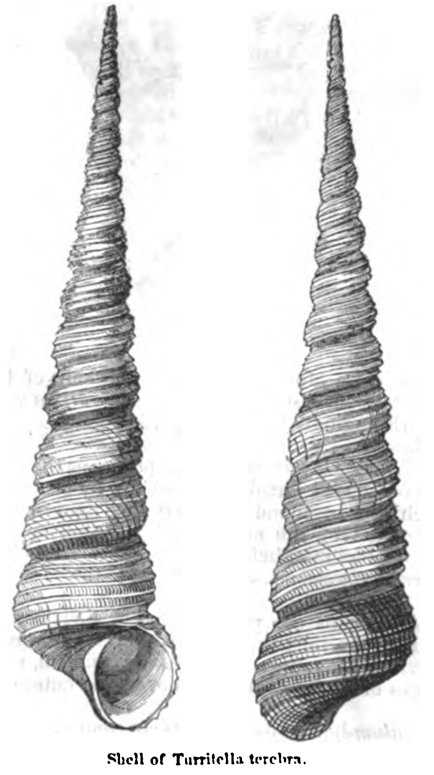
MM. Quoy and Gaimard observe that when dead the shell changes colour, and becomes yellowish, brown, or reddish: but the more or less red striæ are always to be distinguished.

Animal entirely like that of *Cerithium* [ENTOMOSTOMATA, vol. ix., p. 451], of which genus MM. Quoy and Gaimard think that it may form a division. The head, elongated into a proboscidiform muzzle, is brown dotted with black. The tentacles are moderately long, obtuse, white, carrying sessile eyes very near their base. The foot in elongating itself has a quadrilateral form, a little widened in front: it is greenish or yellowish, dotted with brown. The mantle has its contour fringed and sprinkled with whitish lunules, disposed in a rather regular manner.

Operculum very delicate, round, and multispiral, like that of the *Cerithia*. (*Astrolabe*.)



Turritella rosea.
a, shell and animal; *b*, operculum. (*Astrolabe*.)



Shell of Turritella terebra.

Locality.—Found in the *Anse de l'Astrolabe* at New Zealand, at some fathoms depth. MM. Quoy and Gaimard state that their dredge brought up thousands of dead individuals, among which very few living ones were found. They describe them as timid animals, seldom developing themselves, like the *Cerithia*. Length 2 inches 8 lines: breadth 2 lines.

Turritella terebra.

Description.—Shell elongate-turreted, transversely furrowed, fulvo-rufescent or reddish; the whorls convex, very numerous, sulcated, the furrows subequal; spire with an acute apex. This species grows to a length of between 4 and 5 inches.

Locality.—African and Indian seas. (Lam.)

M. de Blainville remarks that the thirteen living species characterised by Lamarck come from the Indian seas, the coasts of Guinea, or those of America. Nevertheless, he says, twelve fossil species occur in France alone. Defrance, he adds, increases the number to 37, from the beds anterior and posterior to the chalk, of which five species are analogous in Italy, according to Brocchi, one in Touraine, and one, identical, in England.

The number of species recorded by M. Deshayes, in his tables, is 24 living and 45 fossil (tertiary); and of these *Turritellæ terebra*, *Ligar*, and two new species, are noted as living and fossil (tertiary).

Mr. Lyell records *Turritella terebra* from the flanks of Etna (clay and volcanic tuff) and from Syracuse. *T. tornata*, from Girgenti (limestone and clay); *T. subangulata*, *tornata*, and *terebra*, from Caltanisetta (clay and yellow sand); *T. terebra* again, from Caltagirone, Palermo, and Ischia; and *T. duplicata* from the last-named locality. *Turritella* occurs also in the list of Red Sea fossils noticed in the article TURBINIDÆ and elsewhere in this work. *T. terebra*, *imbricataria*, *subangulata*, *tornata*, and *varicosa* are recorded by the same author from Sienna; and he figures *Turritella proto* as belonging to the Miocene tertiary period, and *Turritella imbricataria* as belonging to the Eocene tertiary period. Mr. Lea describes *Turritellæ carinata* and *lineata* from the tertiary of Alabama (Claiborne beds).

With reference to the occurrence of *Turritella* below the chalk, we would refer the reader to Dr. Fitton's *Stratigraphical Table*, where five species are recorded, ranging from the upper green-sand to the Oxford oolite, both inclusive. Mr. Murchison describes four species from the Silurian rocks (old red-sandstone, middle and lower beds only; and the lower Ludlow rock).

Proto.

Those who acknowledge *Proto* as a genus, place it, generally, next to *Turritella*.

Generic Character.—Animal unknown.

Shell turriculated, elongated, with numerous spiral whorls, which are convex or gibbous, with a decurrent band at the suture, as in *Subula;* aperture oblique, round, expanded, with the lips disunited; the right lip trenchant, commencing backward much earlier than the left lip, which is very much expanded.

Operculum ?

M. de Blainville, whose description this is, observes that this genus, established by Defrance, seems to contain, as yet, but one living species. As to *Proto terebralis* (the fossil), M. de Blainville thinks that it is either a species of *Potamides* or *Pirena*. [MELANOPSIS.]

M. Deshayes, in his tables, records two living species of *Proto* and four fossil (tertiary).

TURSELLI'NUS, HORA'TIUS, a learned Jesuit, whose real name was Torsellino. He was born at Rome in 1545, and belonged to a distinguished family of that city. He devoted himself from early youth with indefatigable zeal to classical studies. In 1562 he entered the order of the Jesuits. He afterwards taught in the institutions of his order at Florence and Loretto, and in 1579 he was appointed rector of the seminary of the Jesuits at Rome, in which office he continued to exercise a very beneficial influence for twenty years, down to his death on the 6th of April, 1599.

Tursellinus was one of the best Latin scholars that have ever lived, and his work on the Latin particles is still the best book on that subject. His principal works are: 1, 'De Vita S. Francisci Xaverii Libri Sex,' Rome, 1594, the best edition of which is that of 1596, 4to.: the work is of great interest, not only on account of the distinguished man who is the subject of it, but also because it contains much information about the missions of that time. It has been translated into nearly all the modern languages of Europe. 2, 'Historia Lauretana, libri quinque,' Rome, 1597, 4to. This is a history of the miraculous image of the Virgin Mary at Loretto. 3, 'De Usu Particularum Latini Sermonis,' Rome, 1598, 12mo. This very excellent work was reprinted and edited, with additions and corrections, by J. Thomasius in 1673, and by J. C. Schwarz in 1719; it is also printed in the English edition of Facciolati's 'Lexicon totius Latinitatis:' the best edition is that of Hand, Leipzig, 1829, 8vo. 4, 'Epitome Historiarum à Mundo Condito ad annum 1598.' This work is a universal history, in ten books, written in the Italian language. Although it is very brief, it has always been held in high esteem, and has not only been continued by several subsequent editors, but also translated into several other languages.

For a more detailed account of the Life of Tursellinus, see R. Retelius, who has incorporated his work on the Latin particles in his 'Scriptores de elegantiori Latinitate Selecti.'

(Compare Alegambe, *Bibliotheca Scriptorum Societatis Jesu*; Mandosius, *Bibliotheca Romana*.)

TURTLE. [TORTOISES.]

TURTLE. [TESTUDINATA.]

TURTLE-DOVE, *Turtur communis* (*Columba Turtur*, Linn.).

Description.—Male.—Head and nape vinous ash; on the sides of the neck a space composed of black feathers terminated with white; front of the neck, breast, and upper part of the belly light vinous; back brown ash; border of the wings bluish ash; the other coverts rusty with a black spot at the centre of the feathers; abdomen and lower coverts of the tail pure white; tail-feathers blackish ash; all, with the exception of the two intermediate ones, terminated with white; the lateral feather white externally; space round the eyes and feet red; iris yellowish red. Length about eleven inches and a half.

The *Female* has not the white front, nor the colour of the wings so bright; her quills are brownish, whereas they are blackish in the males. (Temm.)

This is the *Tourterelle* of the French; *Tortora* and *Tortora commune* of the Italians; *Turtel taube* of the Germans; *Turtel duif* of the Netherlanders; *Colommen fair* and *Turtur* of the Antient British.

Belon and others consider this species to be the *Trugon* (*τρύγων*) of the Greeks; but though Hasselquist enumerates it among the animals which he saw in the Holy Land, the probability is that *Turtur risorius* [COLUMBIDÆ, vol. vii., p. 373] is the *Tur* or Turtle of the Scriptures.

Geographical Distribution.—Bechstein states that these birds are found throughout the temperate parts of Europe and Asia, and also in many of the South Sea Islands. He says that they do not arrive in the woods of Germany till the end of April or beginning of May, and that they quit that country in September; adding that they are often seen in great numbers in the forests of Thuringia, when the pine seed has ripened well; and that in 1788 there was a prodigious quantity. Pennant relates that Turtle-doves arrive in Italy in May and migrate in September; and the editor of the edition of 'British Zoology' (1812) remarks that they visit Greece rather earlier, and generally come during the month of April in four or five vast flocks. Temminck informs us that it is found high up in the north, but not in the regions of the Arctic Circle. Mr. Yarrell states that he finds no notice of the species visiting any part of Scandinavia or Russia. It was seen by Mr. Fellowes in Asia Minor in 1838; and Mr. H. Strickland saw it in Smyrna in April, 1836. It probably winters in Africa.

Habits, Food, &c.—'The Turtle-Dove,' says Mr. Yarrell, in his accurate and interesting 'British Birds,' now hastening to completion, 'is only a summer visitor here, and, like most of our summer visitors, comes to this country from Africa, and returns there again before winter, not remaining even in the Italian states beyond the middle of autumn. These birds arrive in England about the end of April or the beginning of May, and are rather more numerous in the south-eastern, southern, and midland counties than in those which are farther north. Their appearance is observed and hailed each returning spring, as denoting the season of buds and flowers; and, as emblems of serenity and peace, their mournfully plaintive notes give pleasure. Sportsmen speak of a flight of pigeons, but they say also a *dule* of Turtles, from *doleo*, the term having reference to the particular character of the voice of the bird. They frequent woods, fir plantations, and high thick hedges dividing arable land. They make a thin, almost transparent, platform nest, eight or ten feet above the ground, in the forked branch of an oak, on a fir-tree, or near the top of a thick and tall bush. Upon this nest the female deposits two eggs about the middle of June, according to the observations of Mr. Jenyns. The eggs are white, rather pointed at one end, one inch two lines and a half long, by ten lines in width. The parent birds sit by turns, the male occasionally also feeding his mate during incubation, and both afterwards mutually labouring for the support of the young. In this country they are considered as producing but one brood in the season, but in the south of France these birds are known to have a second pair of young. Their food is grain, particularly wheat, and they are constant visitors to the wheat-field while the corn is growing, and to pea-fields: they also feed on rape and other small seeds. In the autumn they fly in small parties of ten or twelve birds, and leave this country about the end of August, and sometimes as late as the end of September, particularly in those seasons when our harvest is backward. I have several times killed both adult birds and the young of the year when out partridge-shooting in Hertfordshire; but I have observed that these birds are more numerous in the thickly-wooded parts of the middle of the county of Kent than elsewhere.'

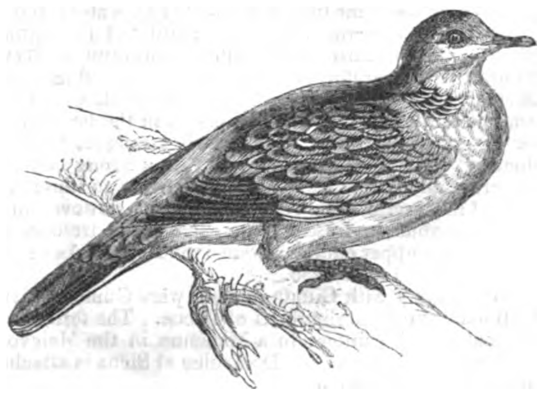
The Turtle-dove has been seen in Ireland and Scotland, as well as in England. With regard to the food of the bird, it is worthy of notice that the editor, in the last edition of the 'British Zoology,' states that the stomach of one of these doves, examined by the Rev. Hugh Davies, in the month of October, contained only some seed of the *Polygonum aviculare*, of rape and of mustard; it must therefore, he observes, at that season have declined from choice every species of bread-corn. Willughby found hempseed in the crop of the individual examined by him.

This elegant dove would be a great addition to our homesteads; and though the migratory impulse is very strong, it may be overcome. Pennant states that about the year 1765 a pair came into his garden at Downing in the winter season, and continued there two or three weeks. Bechstein tells us that young ones reared by a domestic pigeon are easily accustomed to the dovecot; but as they are very sensible of cold, it is necessary to warm the place of their abode during winter. They multiply fast, either when paired with each other or with the Collared Turtle (*Columba* (*Turtur*) *risoria*), and in captivity should be provided with a small straw basket to build in.

In Germany Turtle-doves, Ring-doves (*Columba Palumbus*), and Stock Doves are taken by choosing a place where salt has been strewn in parks for the deer, and so placing a net that it may fall over the birds whilst they are busy pecking the salt.

Few birds have been more sung by poets, or more appealed to by lovers. The old French quatrain in the 'Portraits d'Oyseaux' (1557) thus celebrates its constancy:—

> 'Si la turtrelle ayme bien chasteté,
> Et (mort son pær) gemist sa destinée;
> Qui ne dira instruction donnée
> Estre aux humains d'aymer pudicité?'



Turtle Dove. (Gould.)

TUSCAN ORDER. [CIVIL ARCHITECTURE, vii., 223; COLUMN.]

TUSCAN SCHOOL OF PAINTING. This school of painting is frequently called the Florentine School, and is divided into several epochs, the first of which is termed the old Florentine; but the school of Florence was not the school of Tuscany until after the time of Michel Angelo. In the earliest period of painting in Tuscany the principal painters were of Pisa and of Siena, and there is characteristically no essential difference between their works and those of the early painters of Umbria of the same period. Some Sienese critics have discovered a distinct school in the works of the old masters of Siena, but it would be difficult to show any other distinction than a mere difference of local origin.

Some artists of Siena and Florence, of the early part of the thirteenth century, are the oldest painters of Tuscany that are known. There were painters in Pisa before this time, in the eleventh century, but they were Greeks from Constantinople: and there are also paintings extant in Tuscany which are said to be of the same period, but they are probably the production of Greek artists. In the church della Trinità at Florence there is a picture of Christ painted upon canvass, and glued upon a wooden cross, which is probably of the tenth century; it was done before 1003: and in the church of San Miniato al Monte near Florence there is a Greek painting of San Miniato Martire, of the eleventh century. (*Etruria Pittrice.*) That there were at all times painters in Italy, from the decline of the Roman empire, until the revival of painting in the thirteenth century, is certain, from the remains still extant in many cities of Italy; from the illuminations in manuscripts; from the mosaics; from the painted series of popes in the Basilica of San Paolo, commenced in the fifth century by order of St. Leo, and from other evidence.

The first considerable efforts towards the revival of painting were made by the Tuscans, and the Tuscan painters throughout have done much towards its improvement and perfection in later periods. The following masters are among the most celebrated in the history of painting, both for their works and for the great changes they effected in the prevailing styles of their respective periods:—Giotto di Bondone of Vespignano (b. 1276, d. 1336); Tommaso Guidi of San Giovanni, called Masaccio (b. 1401 or 1402, d. 1443); Lionardo of Vinci (b. 1452, d. 1519); Michel Angelo Buonaroti of Castell' Caprese, in the diocese of Arezzo (b. 1474, d. 1563); Ludovico Cardi of Cigoli (b. 1559, d. 1613); and Pietro Barrettini of Cortona (b. 1596, d. 1669). All these painters, through the striking characteristics of their respective styles, made epochs in the history of painting in Tuscany.

I. The oldest Tuscan artists whose names are known are Niccola and Giunta of Pisa. Niccola Pisano, or of Pisa, was a sculptor, and the first restorer of design from the excessive rigidity of the Byzantine forms; he endeavoured to imitate the style of a bas-relief upon an antient sarcophagus at Pisa: he lived at the beginning of the thirteenth century. Giunta Pisano is the earliest Tuscan painter to whom extant works have been assigned; he is said to have learnt painting of some Greeks who were at Pisa about the year 1210. In 1230 he was employed in the church degli Angeli at Assisi: there are a crucifixion and some other figures painted upon a wooden cross, the colours of which are mixed in some medium not affected by water; and at the bottom of the cross there is a mutilated inscription, thus restored by Lanzi: 'Junta Pisanus Juntini me fecit.' The drawing is careful, but very dry, and the fingers are extremely long—faults, as Lanzi has observed, not of the men, but of the times. The expression in the heads however is good, the draperies are well arranged, and the colouring, though brown, is laid on with a strong impasto. This crucifixion, says Lanzi, is not inferior to those of a similar kind ascribed to Cimabue; he was however inferior to Cimabue in fresco. There are some frescoes by Giunta in the upper church of San Francesco at Assisi: he is not mentioned after 1236.

Contemporary with Giunta of Pisa, were Guido of Siena and Buonaventura Berlinghieri of Lucca. The former was illuminator and painter: to a Madonna in the Malevolti chapel in the church of San Domenico at Siena is attached the following inscription—

> 'Me Guido de Senis diebus depinxit amenis
> Quem Christus lenis nullis velit agere poenis.'
> An. 1221.

There is an engraving of this Madonna in Lastri's 'Etruria Pittrice:' its merits are very great for its period. Siena had many other painters about this time, and they were even constituted as a civil body in 1250. Ugolino of Siena, says Vasari, painted pictures and chapels in every part of Italy; he died at an advanced age in 1339. Buonaventura Berlinghieri of Lucca painted in 1236: there was also a Deodato of Lucca, who was living in 1288.

A very superior painter to those already mentioned, and one who added also much to the practical technic of painting, was Margaritone of Arezzo, an older painter than Cimabue. At the church of Santa Croce at Florence there is a Crucifixion by Margaritone which is placed near one by Cimabue; and although Magaritone's is less finished in execution than Cimabue's, the difference is not so great that the title of painter should be denied to the former and given to the latter. The portrait or picture of San Francesco di Assisi in the church of Sargiano near Arezzo, dressed in the habit of a monk, with all the faults of the time, has a grand expression, and is a very remarkable production: it is marked—Margarit' de Aretio *pingebat*, an inscription which probably indicates a Greek source of instruction, directly or indirectly.

The earliest painter in Florence was apparently Maestro Bartolomeo, who painted in 1236. An Annunciation, which he painted in the church de' Servi, has been attributed to Cavallini, the scholar of Giotto. Another predecessor of Cimabue was Andrea Tafi, born in 1213; he was the scholar of Apollonius, a Greek, whom he assisted in some mosaics in San. Giovanni at Florence. Vasari terms Tafi the first restorer of mosaic in Tuscany: he was also a painter.

A painter of somewhat more merit and much more fame than any of the preceding was Giovanni Cimabue, born at Florence in 1240, through the partiality of Vasari or his neglect of research, commonly called the father of modern painting. He was architect and painter; he greatly improved the proportions of the human figure in design; inspired his figures with more life than his predecessors; and excelled them in grace of execution and in richness of colouring: his works are, notwithstanding, strictly of the Byzantine style. Cimabue is said by some to have learned painting of Giunta Pisano, whom he assisted in his frescoes at Assisi, in 1253, in his thirteenth year: Vasari says he learned of some Greeks who were employed to decorate the church of Santa Maria Novella at Florence. One of his earliest and most remarkable pictures is the Colossal Madonna, now in the Academy at Florence, formerly in the church of Santa Trinità; but his greatest works are those in the upper church of San Francesco at Assisi. Cimabue excelled chiefly in male heads, to which he has sometimes given a truth and grandeur of expression that have never been much surpassed. Contemporary with Cimabue, but somewhat younger, was Ducio di Buoninsegna of Siena, famous in his time: he painted great works in the cathedral of that place, which are in part still extant: also a remarkable altar-piece for the same church, which is still preserved there; it was painted in 1308 and 1311, and when completed was carried in procession to the cathedral. It was painted on both sides, but is now cut into two. On one side, the former front, is a Madonna and infant Christ, surrounded by angels; on the other side, or former back, there is a series of small pictures illustrating the history of the Passion, all containing many figures, executed with surprising industry, skill, and judgment, when compared with the majority of the works of his contemporaries.

Gaddo Gaddi of Florence, born in 1239, was also one of the most distinguished artists of this period. He was celebrated for his works in mosaic, of which there are still specimens in the cathedrals of Florence and of Pisa. He worked also at Rome, but the great mosaics of St. John Lateran and in Santa Maria Maggiore are the work of Mino da Turrita, an earlier master, and the most celebrated of his time. The mosaics of the tribune of San Giovanni at Florence were executed by Turrita, who finished them in 1225; this date is added to the following inscription upon the ground of the mosaics:—

> 'Sancti Francisci Frater fuit hoc operatus,
> Jacobus in tali præ cunctis arte probatus.'

II. That of discovering and cultivating the abilities of Giotto was not one of the least services of Cimabue. [GIOTTO.] Giotto surpassed all his predecessors, and he added as much to the art of his master Cimabue as Cimabue had added to that of the Greeks. In the mature works of Giotto there are no traces of the Byzantine style: they made an epoch in painting;* and from his time Florence dates its preponderance in the history of Tuscan art. If Cimabue, says Lanzi, may be termed the Michel Angelo of his age, Giotto may be termed its Raphael. Great as was the fame of Cimabue, says Dante, it was rendered obscure by that of Giotto. Dante and Giotto were friends, and the great poet celebrated the painter in the following well known lines:—

> 'Credette Cimabue nella Pintura
> Tener lo campo; ed ora ha Giotto il Grido,
> Si che la fama di colui s'oscura.'—*Purgatorio*, xi. 32.

Giotto was painter in history, miniature, portrait, and in mosaic; also a sculptor and an architect: the celebrated Campanile of Florence is his work. He painted in many cities of Italy, but his chief works are those in the lower and upper churches of San Francesco at Assisi. In these paintings there are heads worthy in expression of the greatest masters that have succeeded him; yet, notwithstanding his great merits, his design is extremely hard and Gothic, especially in his large figures: he paid also little attention to perspective or to chiar'oscuro; and although he brought painting far from its infancy, he still left it upon the whole as far from its maturity.

The scholars and imitators of Giotto were very numerous: the principal of them were Stefano Fiorentino, Tommaso di Stefano, called Giottino, and Taddeo Gaddi, the son of Gaddo Gaddi. These painters worked in the same style as Giotto, sometimes inferior and sometimes superior in execution. Stefano was called the ape of nature, 'Scimia della Natura.' Taddeo Gaddi, says Vasari, excelled Giotto in colouring and in tone: his principal works were painted in the church of Santa Croce; and in the chapel Degli Spagnuoli, in the church of Santa Maria Novella. The pictures of the three saints seated in this chapel are magnificent in the character of the heads and in the style of the draperies: they represent San Dionysio Areopagita, San Pietro Lombardo, and San Severino Boezio: they are engraved in Lastri's 'Etruria Pittrice.' Contemporary with Giotto was Buonamico di Cristofano, called Buffalmacco, the scholar of Andrea Tafi; and Bernardo and Andrea Orcagna, who painted together a heaven and a hell in the Struzzi chapel in the church of Santa Maria Novella; and in the Campo Santo at Pisa, Andrea painted a Last Judgment, and Bernardo a hell. In the church of Santa Croce also Andrea painted similar scenes: amongst the blessed he placed his friends, and amongst the damned his enemies. The best preserved works of Buffalmacco are at the Campo Santo at Pisa.

Two celebrated scholars of Andrea Orcagna were Bernardo Nello of Pisa and Francesco Traini of Florence: of the latter there is a celebrated picture of Thomas Aquinas at Santa Caterina at Pisa.

Contemporary also with Giotto was the famous Simone Memmi di Martino of Siena, celebrated by Petrarch in two of his sonnets for a portrait of Laura. The same poet mentions him also in one of his letters, where he says, 'I have known two distinguished and excellent painters, Giotto, a citizen of Florence, whose fame among moderns is immense, and Simone of Siena.' Simone was born about 1284, and after distinguishing himself by many works in various cities in Italy, he went to Avignon, where he died in 1344. He excelled in composition and in invention. Vasari speaks very highly of his great works in the chapel Degli Spagnuoli, in the church of Santa Maria Novella at Florence, which was painted in 1332. Christ going to Calvary, which is one of the paintings of this chapel, is a work of great merit in expression, in composition, and in design. (Lastri, *Etruria Pittrice*.) There is in the Ambrosian Library at Milan a MS. of Virgil with the commentary of Servius, which belonged to Petrarch; and on the frontispiece is a miniature of Virgil writing, with various characteristic accessories, by Memmi: it is supposed to have been painted for Petrarch, and that the poet wrote the following lines attached to it:—

> 'Mantua Virgilium qui talia carmina finxit;
> Sena tulit Simonem digito qui talia pinxit.'

Shortly after the death of Giotto, in 1336, painters commenced to be extremely numerous in Tuscany. In the year 1349 the painters of Florence formed themselves into a society under the name of Compagnia di San Luca (company of St. Luke). This society was not however composed exclusively of painters: it contained various artists in metal and in wood, in whose business ornamental design was in any way concerned. A similar institution, but on a greater and more permanent plan, was established at Siena in 1355.

Other distinguished painters of this period were—at Siena, Lippo Memmi, Cecco di Martino, Ambrogio Lorenzetti, and Bernardo or Berna da Siena. At Florence were Giovanni and Angelo Gaddi, the sons of Taddeo Gaddi. Angelo Gaddi was an excellent colourist; but he was content to imitate the works of Giotto and of his father. His scholar Cennino Cennini was also a good colourist. The following also are deserving of mention: Starnina, Dello Fiorentino, Jacopo di Casentino, Spinello Aretino and his son Pari Spinelli, Lorenzo di Bicci and his son Neri, also Giovanni di Niccolo of Pisa, who all painted more or less in the style of Giotto, as did likewise all the artists of Tuscany, until a better taste was spread by the works of Masaccio.

III. In the fifteenth century, when the Medici established themselves as the rulers of Florence, and that city gradually extended its power over the neighbouring territories, and became the capital of Tuscany in matters of art as well as of state, the arts were in a manner rendered dependent upon the caprices or tastes of its princes; and as the Florentine artists, through extended patronage, gradually evinced more activity, and acquired as a body a greater importance, those of Siena and Pisa proportionably declined in both respects. The improvements made in painting at this period were very great, and one of the most essential was the commencement of a proper application of perspective: the chief promoters of this science were Pietro della Francesca and Paolo Uccello; the latter comparatively neglected every other department of painting for the study of perspective. There is in the first cloister of Santa Maria Novella a picture of the Drunkenness of Noah, by Uccello, in which he has displayed his ability in this respect: Noah is violently and well foreshortened. Another department of painting which had been neglected by the school of Giotto was chiaroscuro. This was first attempted with success by Masolino da Paincale, who executed some excellent works, for the period, in the chapel of San Pietro in the church del Carmine. Masolino is also not less distinguished for having been the master of the celebrated Masaccio, who, if any individual is entitled to this distinction, alone can be styled the father of modern painting.

That many of the painters however who preceded Masaccio had great ability, even for any period, is certain; and it is also certain that they had recourse to the study of nature—a fact which proves that the mere study of nature, without the knowledge of what to select for imitation, will not lead to the production of fine forms. And although beautiful forms have been produced by the earlier painters, it is the accident of the model, and not the result of choice; for we sometimes find the finest parts associated with others so inferior, that from their juxtaposition the whole has an appearance of deformity, which arises both from the inequality in individual models, and from the painter's occasionally trusting his own knowledge and occasionally having recourse to the model. This imperfection could only be avoided by the adoption of a standard of form, which should preserve a unity of style in every degree—a standard which, experience has shown us, it would require centuries to attain simply by the study of nature, because of the infinite varieties of form met with in individuals. This standard however already existed in the antique, and it required only the master-mind to appropriate it; and to have been the first to do this efficiently constitutes the great merit of Tommaso Guidi, commonly called Masaccio, on account of the slovenliness of his personal appearance. Masaccio introduced a style of composition and design which until the appearance of Da Vinci and Michel Angelo experienced no material change. Da Vinci and Fra Bartolomeo enlarged upon Masaccio's style. Michel Angelo invented a style of his own, and he outlived it. The style of Masaccio however, expanded to its utmost, still lived in the works of Raffaelle and the principal painters of the Roman school. Yet the great improvement in design which was accomplished in the works of Masaccio was not entirely his own merit; for Ghiberti and Donatello had made great advancement in sculpture; and Gentile da Fabriano and Vittore Pisanello, with whom Masaccio became acquainted in Rome, had made great improvements upon the Giottesque school in painting. Masaccio's greatest works are in the Brancacci chapel in the church of Santa Maria del Carmine at Florence: they have been engraved by Lasinio and others. Masaccio died before the completion of these works, in 1443, in his forty-first or forty-second year, not without suspicion of having been poisoned. Many of his works have perished. His most able contemporaries and followers were Fra Giovanni da Fiesole, Benozzo Gozzoli, and Fra Filippo Lippi, the best painter of his time; he completed the works of Masaccio in the Brancacci chapel: he died in 1469. There are in his works much of that mellowness of colouring and harmony of light and shade which characterise the works of Fra Bartolomeo and Lionardo da Vinci. In the gallery of the Academy at Florence there are some beautiful specimens of the works of Lippi.

Other painters of great ability of this period, both in oil and in fresco, were Andrea del Castagno, called the infamous; Sandro Botticelli, Filippino Lippi, Raffaellino del Garbo, Domenico del Ghirlandaio, Cosimo Roselli, Piero di Cosimo, Antonio Pollaiuoli, the first Italian painter who studied the dead subject for the purposes of design; Andrea Verocchio, and Luca Signorelli of Cortona. There were also many others of merit of this school at about the end of the fifteenth century, but they followed only in the steps of others.

IV. The works of Lionardo da Vinci and the painters who imitated or adopted the chief characteristics of this style constituted another epoch in the history of painting: but their influence was not confined to Florence or to Tuscany; it was greater in Milan and in Lombardy than in Florence. The fulness however and vigour of design which distinguish the works of Fra Bartolomeo, and even Michel Angelo, characterise in an equal though somewhat different degree also the works of Da Vinci, and are combined with an exquisite finish and harmony of tone which are peculiar to himself. Lionardo was born at Vinci in 1452, and learnt painting of Andrea Verocchio, who, upon seeing the superiority of his scholar, forsook that art for statuary. Lionardo was painter, sculptor, architect, engineer, mathematician, writer, musician, and poet; he is however chiefly known as a painter. Historians have divided his career into four periods; he painted at first in the style of Verocchio, and his pictures of this time are lighter in style of design, and have less strength of chiaroscuro, than his later works. His second period was that spent at Milan in the service of the Duke Sforza, when he painted his Last Supper. The third was his great Florentine period, from 1500 until 1512, when he executed the famous cartoons of Santa Anna, and of the Battle of Niccolo Piccinino, called the Battle of the Standard; and his own portrait in oils, which is in the gallery at Florence—a work which for painting cannot be surpassed. In the fourth period he was comparatively inactive. In 1512 he returned to Milan; in 1514 (Vasari says 1513) he visited Rome; and in 1516 he went with Francis I. to France, where he died, at Fontainebleau in 1519, aged 67. [VINCI.]

When Da Vinci returned in 1500 to Florence, the only painter there of extraordinary ability was Fra Bartolomeo di San Marco, or Baccio della Porta, commonly called Il Frate, then in his twenty-ninth year. Michel Angelo was at that time in his twenty-sixth year only, and had done nothing in painting, having confined himself up to that time nearly exclusively to sculpture; which rendered the more remarkable his great success in 1506, in the so-called cartoon of Pisa, executed by order of the gonfaloniere Pietro Soderini, for one end of the council-hall of the old palace of the Signory, for the other end of which Da Vinci made his cartoon of the Battle of the Standard, in which a group of horsemen were contending for some colours, with various accessories.

The good effects of the munificence of Lorenzo de' Medici and his encouragement of the arts did not completely show themselves until after the second restoration of the Medici in 1512. This was owing to the anarchy which immediately followed upon the death of Lorenzo in 1494; a period pernicious to the arts, through the fanatical exhortations of the monk Savonarola: notwithstanding we owe to this time the two celebrated cartoons just mentioned. Lorenzo established an academy in his garden near the church of San Marco, and formed a splendid museum of antient and modern works of art: it was the nursery of all the great artists of Florence of the early part of the sixteenth century. Some singular scenes were enacted by Savonarola during his short triumph over the general order of things. In 1497, at the time of the Carnival, instead of the usual bonfire in the market-place, Savonarola had a large scaffolding prepared, and upon this he piled many of the most excellent works of the Florentine artists, both in painting and sculpture, including the busts and portraits of several beautiful Florentine females, with many foreign tapestries condemned on account of their nakedness: and they were all burnt amidst the rejoicings of the populace. In 1498, the following year, he repeated the scene on a much greater scale: on this pile was burnt an illuminated copy of Petrarch. Fra Bartolomeo, Lorenzo di Credi, and other distinguished painters, took part in this fanatical destruction.

Fra Bartolomeo imitated, or rather painted in a very similar style to, Lionardo da Vinci. Several of his works are in many respects admirable, and in composition, in expression, in the cast of draperies, and in design, bear the strongest resemblance to the works of Raffaelle: the great figure of St. Mark, in the Pitti palace, combines with the style of Raffaelle much of the grandeur of the prophets and sibyls of Michel Angelo in the Sistine chapel. Bartolomeo was the true master of Raffaelle: these two great painters contracted a friendship for each other in 1504, when Raffaelle was in Florence and only twenty-one years of age. Bartolomeo died in 1517, three years before Raffaelle. Mariotto Albertinelli followed the style of Bartolomeo, and painted many excellent pictures.

Andrea Vannucchi, called del Sarto from the trade of his father (a tailor), was also one of the most distinguished of all the Florentine painters. He was the scholar of Piero di Cosimo, and had great ability of execution, but he wanted invention. His style in colouring and in chiaroscuro is similar to that of Fra Bartolomeo, but from the study of the cartoon of Pisa he had acquired much of the style of Michel Angelo in design. His easel pictures are very numerous. He died in 1530.

V. Michel-Angelo Buonaroti, painter, sculptor, and architect, the scholar of Domenico Ghirlandaio, revolutionized painting not only in Tuscany, but in Italy, yet although his style can scarcely be said to have anything in common with that of any of his predecessors, he was anticipated in some of the greatest beauties of composition and design by Da Vinci and by Raffaelle. The chief characteristics of his works are severe grandeur of design and an occasional sublimity of invention: the frescoes of the vault of the Sistine chapel, painted in 1512, are in these respects unrivalled by any other works. The cartoon of Pisa however was by some contemporary critics considered to be a superior work in design: it represented many soldiers of Pisa suddenly called to arms when bathing in the Arno and was a very superior work to the rival cartoon of Lionardo da Vinci. Benvenuto Cellini calls these two cartoons the school of the world, so long as they were exhibited to the public: Vasari speaks to the same effect. They were both lost a few years after they were made, in a manner never accounted for. Michel Angelo's was cut in pieces. There is an old print of Lionardo's by Edelinck, made from a bad drawing; and Marcantonio and Agostino Veneziano both engraved parts of Michel Angelo's. The style of Michel Angelo has its faults, independent of an excessive muscular development: he had but one standard of form for man, woman, and child, of every age and every degree; his women are female men, and his children diminutive giants. His great works are his single figures, but his paintings are as statuesque as his statues, and express a similar character: his Moses, his Lorenzo de' Medici, in sculpture; his Daniel, and his Jeremiah or Isaiah, in painting. His Last Judgment, a vast work, but the production of his old age, has the faults of his other works without their grandeur or sublimity; it was finished in 1541, in his 67th year. [ROMAN SCHOOL.] Michel Angelo made many drawings, but he painted scarcely anything in oil. Though the great works of Michel Angelo were executed at Rome, they influenced chiefly the Florentine school; and what has been said of the Roman school of this period is true also of the Florentine, except that the painters of Florence, unlike those of Rome, were not held in restraint in their imitation of Michel Angelo by any veneration for the works of Raffaelle. The imitation was therefore the more palpable, and it was an imitation of *manner* only, not of *style*. The anatomical school is the best designation for the Florentine imitators of Michel Angelo. Francesco Granacci and Daniel Ricciarelli of Volterra were the least mannered of his scholars. The latter, though he painted in his style, was more correct in design than Michel Angelo: his women, says Mengs, have more grace, yet still they are ugly; but his draperies were even worse than Michel Angelo's: he was weak also in chiaroscuro. He painted however with great care, and his Descent from the Cross, in the church of Trinità de' Monti, is reckoned one of the finest pictures in Rome. Another celebrated follower of Michel Angelo was Giorgio Vasari; he is better known however for his lives of the painters, sculptors, and architects, than for his paintings. He executed an immense number of works, but beyond a general correctness of drawing they have nothing to recommend them. Other followers and imitators of his style were Sebastiano del Piombo, Marcello Venusti, Federigo Zuccaro, Francesco Rossi de' Salviati, Jacopo del Conte, Angelo Bronzino, and Alessandro Allori. Painters of this period who were not carried away with the host of imitators were Franciabigio, Jacopo da Pontormo, and Domenico Puligo, scholars of Andrea del Sarto; besides some others of less note: also Il Rosso, or Maître Roux, as he is called by the French.

VI. At the end of the sixteenth century a new style was introduced by Ludovico Cardi, commonly called Cigoli, which combined careful drawing with brilliant colouring. Santi di Titi preceded him in his indifference towards the anatomical school, and he was greatly assisted in establishing his own style by Gregorio Pagani and Domenico da Passignano. This school was founded upon the style of Baroccio and that of Correggio, and had much in common with the eclectic school of the Carracci. Its ascendency was promoted by the works of the Venetian Ligozzi at Florence, and by the school of Francesco Vanni at Siena. These painters were followed by younger artists, by Giovanni Biliverti, Fabrizio Boschi, Cristofano Allori, Jacopo da Empoli, Giovanni Battista Vanni; also Matteo Roselli and his scholars Giovanni Manozzi da San Giovanni, Baldassare Franceschini, called Il Volterrano, and Francesco Boschi, an excellent portrait painter: likewise by Francesco Turini and his scholar Simone Pignone; and Lorenzo Lippi, like his friend Salvator Rosa, poet and painter.

Also in a somewhat similar taste of colouring and design, though in a very different style of execution, painted Carlo Dolci: his elaborate finish however is the principal merit of his works; his colouring is often green, yet some of his female heads are executed in exquisite taste. He died in 1686.

VII. In about the middle of the seventeenth century another change took place in the style of the Florentine painters, as well as in that of the Roman, through the extensive and attractive works of Pietro Berrettini da Cortona, in Florence and in Rome. The style of Cortona prevailed only partly in Rome, through the opposition of Andrea Sacchi, Carlo Maratta, and other painters who had adopted a better taste, disseminated by the works of the great Bolognese painters of the school of the Carracci. [Roman School.] In Florence the style of Cortona attained completely the ascendency, and prevailed the whole of the seventeenth century and the greater part of the eighteenth. He was invited to Florence about the year 1637, and was occupied for several following years over his great allegorical frescoes in the Pitti Palace; he left them however unfinished: they were completed by Ciro Ferri, his most distinguished follower. Cortona paid little attention to expression; his object was to produce a grand effect on the whole: his style was decorative, and his works will not bear inspection in the parts. As regards picturesque effect he grouped admirably, and his compositions are extensive; and there can be no question that his style was the best that could be adopted for the manner in which it was applied on the ceilings of palaces and of churches. He is the head of those artists called machinists by the Italians. His principal followers in Florence were the three Dandini and their scholars, Antonio Domenico Gabbiani and others, and his scholar Benedetto Luti; also Salvi Castelluci, Giacinto and Ludovico Gimignani, Lazzaro Baldi, Allessandro Gherrardini, and Sebastiano Galeotti. Two of the most distinguished Florentine artists of the end of the eighteenth century were Gio Battista Cipriani and the landscape painter Francesco Zuccherelli, who both spent some time in this country: also Tommaso Gherardini, who died in 1797, and Pietro Pedroni, who died in 1803, are reckoned among the best painters of their period.

(Vasari, *Vite de' Pittori, &c.*; Baldinucci, *Notizie de' Professori del Disegno, &c.*; Della Valle, *Lettere Senesi*; Lastri, *Etruria Pittrice*; Lanzi, *Storia Pittorica*; Fiorillo, *Geschichte der Mahlerey*, vol. i.; Speth, *Kunst in Italien*; Rumohr, *Italienische Forschungen.*)

TUSCANS. [Etruria.]

TUSCANY (*Toscana* in Italian), a division of central Italy, with the title of grand-duchy, situated south of the main ridge of the Apennines, and between it and the Mediterranean Sea. Its greatest length is from 42° 22′ N. lat., where the small river Pescia, which falls into the sea, marks the boundary between Tuscany and the Papal province of Viterbo, to 44° 30′, where Mount Gisa above Pontremoli divides the Tuscan part of the Val di Magra, or Lunigiana, from the valley of the Taro in the duchy of Parma. Tuscany is bounded on the west by the sea, and partly by the Sardinian territories; on the north by the duchies of Parma and Modena, and by the Papal provinces of Bologna and Romagna; on the east by the Papal provinces of Urbino and Perugia; and on the south by that of Viterbo, and partly by the sea.

The form of Tuscany is oval, and its greatest breadth is about 95 miles from west to east, from the sea-coast near Leghorn to Borgo San Sepolcro on the banks of the Upper Tiber, which part of the valley of the Tiber belongs to Tuscany. [Papal State.] There is also a mountainous tract belonging to Tuscany on the northern slope of the Apennines, encroaching on the Papal province of Romagna, and extending to within a few miles of the Papal towns of Faenza and Forlì. This district, which is styled 'Romagna Gran-Ducale,' contains the sources and upper course of a number of streams, the Santerno, Senio, Lamone, Montone, Ronco, Savio, and Marecchia, which flow towards the Adriatic. With this exception, the waters of the grand-duchy of Tuscany flow southwards to the Mediterranean. The principal rivers of Tuscany are, beginning from the north—1, the Magra, which flows through the Tuscan district of Lunigiana, and afterwards enters the Sardinian state; 2, the Serchio, which flows through the Tuscan part of Garfagnana and through the territory of Lucca, which territory forms geographically part of Tuscany; 3, the Arno, which, with its numerous affluents, including the Chiana, drains more than one-third of Tuscany; 4, the Cecina, which drains the valley of the same name; 5, the Ombrone, the principal river of the province of Siena; 6, the Albegna, which flows for about 36 miles through the southern part of the Maremme, passing near the ruins of Saturnia, and enters the sea north of Mount Argentaro; 7, the Fiora, which flows through the border district of Santa Fiora, Pitigliano, and Sovana, and then enters the Papal territory.

The surface of Tuscany presents four different regions:—1, the highlands of the Apennines, which skirt the grand-duchy on the north and north-east; 2, the hilly tract, which forms the greater part of the province of Siena, between the valley of the Chiana on one side and that of the Arno on the other, and which slopes on the south-west towards the lowlands of the Maremma. The Ombrone forms the principal drain of this extensive plateau, which is intersected by rather high ridges, some of which are ramifications of the great Apennine chain, whilst others, like Monte Amiata and the mountain of Radicofani, are of volcanic formation. The lower hills are of the description called by Brocchi and other geologists 'Subapennine.' [Apennines.] 3, The great valley of the Arno, with the lateral valleys of the Chiana, Elsa, Era, and other affluents. This constitutes the finest, most productive, and most densely inhabited part of Tuscany: 4, the maritime plains, or Maremme. Distinct sketches of these four regions are given under the heads Arno; Chiana, Val di; Florence, Province of; Garfagnana; Maremme; Pisa, Province of; Siena, Province of.

The area of the grand-duchy of Tuscany, including its dependencies, the islands of Elba, Gorgona, Pianosa, Giglio, Gianutri, and Monte Cristo, is reckoned at 8060 Tuscan square miles (the length of the Tuscan mile is at the rate of 67½ to 1° of latitude). By the census of 1836 the population was 1,436,780. In 1737, when the present dynasty of Austria-Lorraine took possession of the grand-duchy after the death of the last Medici, the population was 890,600. In 1791 it had risen to 1,058,000; in 1799 it was 1,104,000 and it has since been gradually increasing at the rate of between 12,000 and 13,000 individuals yearly.

About one-sixth part of the area of Tuscany is planted with vines and olive trees; another sixth is cultivated as arable land; nearly two-sixths are either forests or plantations of chestnut-trees, which afford food to the population of the mountains; and nearly as much again is pasture land, chiefly natural pasture. The number of landed proprietors amounted in January, 1835, to 132,845, of which 790 were corporate bodies, either clerical or lay. Of the whole number, only ten enjoyed an income derived from land or houses of more than 100,000 Tuscan livres, or 3333*l.* sterling; 29 had from 30,000 to 40,000 livres; but by far the greatest number was of those whose income did not exceed 100 livres. The whole rental of Tuscany subject to the land-tax is, according to the new 'Catasto,' 44,339,806 Tuscan livres. There is a class of tenants who hold their tenements by 'livello,' a kind of life-estate for four generations, paying a fixed yearly rent either in money or kind to the owner. When the fourth generation is about to expire, the contract is often renewed by mutual agreement. But the most common way of letting land is on the 'metayer' system, by which the farmer finds half the seed and implements, and gives the owner half the produce in kind. The landlord stocks the farm, and a valuation is given to the farmer, who is to make all good on leaving.

Tuscany imports upon an average 860,000 sacks of corn yearly to supply its own consumption. The principle articles of produce are—wine, of which there are many kinds, some very fine and delicate, but little of which is exported; oil, an article of common use among the people, and of which a quantity is exported yearly to the value of about 100,000*l.* sterling; silk is exported, either spun or woven, to the value of about 120,000*l.* The other articles of native produce exported are—fruit of various sorts, lamb-skins and kid-skins, potash, timber, cork, juniper berries, marble and alabaster, iron from Elba, borax, sulphur, alum, and anchovies, which are fished off the coast. Nearly the whole trade of Tuscany with other countries is carried on through the port of Leghorn, which is also a great mart or exchange for all kinds of foreign produce. [LIVORNO.] Horned cattle are not very numerous in Tuscany; the sheep are reckoned at 600,000; most of the flocks migrate in the autumn from the highlands to pass the winter in the Maremme. Cheese is made of ewes' as well as goats' milk. The common horse is of an inferior kind; some studs however keep up a superior breed. The asses are strong and fine. Pigs are reared in great number in the woods of the Maremme, where they feed upon acorns. A herd of about 200 camels is kept up on the grand-ducal farm of San Rossore near Pisa, and is said to have been perpetuated there ever since the time of the Crusades. Game of most kinds is abundant.

The mineral products are—iron, from the island of Elba, the ore of which is smelted and cast on the opposite coast of the mainland, at Cecina, Valpiana, and Follonica; copper from Montecatini; lead and marble from Seravezza; sulphur from Pereta and Ajola; rock-salt from Volterra; alabaster from Castellina Marittima; alum from Montioni; sea-salt is produced chiefly on the coast of Elba. [ELBA.]

The manufactures of Tuscany are rather numerous: they consist of common woollens; woollen caps for the Levant; hemp and linen cloth; thread silk, and silk stuffs, which employ nearly 3500 looms; paper, which is the best made in Italy; glass, leather, wax; coral, which is gathered on the coast of Barbary and worked at Leghorn; iron-ware, alabaster vases and other ornaments wrought at Volterra; china and delft ware. The straw-plat manufacture, which was at one time of great importance, has much declined of late years. [STRAW-PLAT MANUFACTURE AND TRADE.]

The grand-duchy of Tuscany is divided, for the purpose of administration, into five compartimenti, or provinces:—Firenze, Arezzo, Pisa, Siena, and Grosseto. Each province is administered by a provveditore. The province of Florence contains 28 cancellerie, or districts, at the head of which is a civil officer called cancelliere, and is subdivided into 90 'comunità,' or communes. Each commune is presided by a municipal officer styled gonfaloniere. The province of Arezzo has 17 cancellerie and 42 communes; that of Pisa, 15 cancellerie and 53 communes; that of Siena, 10 cancellerie and 34 communes; and that of Grosseto, 9 cancellerie and 21 communes. For the judicial administration there is in every commune a magistrate, called in some places Vicario, and in others Potestà; there are primary courts for civil and criminal affairs in each of the principal towns; four courts of appeal called Ruote, at Florence, Siena, Arezzo, and Pisa; and lastly, a 'Supremo Consiglio di Giustizia Civile,' at Florence, which receives appeals in civil matters from the Ruote, and an 'Imperiale e Reale Consulta,' that watches over the whole judiciary administration. The Ruota of Florence is the supreme criminal court for the whole grand-duchy. In commercial affairs there are tribunals of commerce at Florence and Leghorn. The 'Presidenza del Buon Governo,' at Florence, is the chief board of police for the whole grand-duchy; there are commissaries of police in the principal towns, and a body of 'Sbirri,' or police force scattered about various points of the country.

The military establishment is small, amounting to about 5000 men, including the police. The regulars are formed into two regiments of infantry, each of three battalions; a regiment of cacciatori (cavalry), a battalion of grenadiers, a battalion of artillery, a battalion of veterans, and a corps of invalids. There are besides three voluntary battalions of coast-guards.

The yearly public revenue of Tuscany amounts to sixteen millions of francs, or about 640,000 pounds sterling, derived chiefly from customs, land-tax, income-tax, stamps, government monopoly of salt and tobacco, lotteries, and crown demesnes. The expenditure consists of 1,848,000 francs for the civil list, three millions for the military, and eleven millions for the expenses of administration and other items. The expenditure of the communes is provided for by their own self-taxation, 'tasse-communali,' which amounts in all to about three millions of francs, or 120,000*l.* sterling. Provisions on entering the walled towns pay an 'octroi,' or duty, at the gates, as in France.

The grand-duchy of Tuscany may be considered to rank, for population and importance, with the minor kingdoms of the German Confederation, Würtemberg, Hanover, Saxony, or the grand-duchy of Baden. The grand-duke of Tuscany is an independent sovereign, acknowledged as such by all the powers of Europe; and although he is closely related to the imperial house of Austria, his dynasty is quite distinct from the imperial dynasty of the hereditary states. He stands in the same relation to Austria as the king of Hanover stands to Great Britain. The grand-duke is absolute, but he governs according to the established laws, customs, and precedents: he is assisted by a council of state, composed of his secretaries of state for the four departments of the interior, foreign affairs, war, and finance, and other honorary members. He keeps chargés d'affaires at the courts of Austria, France, and the Porte. At the other courts he is represented by the imperial minister of Austria. Tuscan consuls are appointed to all the principal ports of Europe, the Levant, and America.

The present grand-duke is Leopold II., styled 'Imperial prince of Austria, royal prince of Hungary and Bohemia, archduke of Austria, and grand-duke of Tuscany.' He was born in October, 1797, and succeeded his father Ferdinand III., in June, 1824. He married in 1817 a princess of Saxony, who died in 1832, and by whom he has two daughters. He married again in 1833, Maria Antonia, a princess of the Two Sicilies, who has given him a son and several daughters. One of his sisters, Maria Theresa, is married to Carlo Alberto, king of Sardinia.

The Roman Catholic is the established religion of Tuscany, and is professed by all Tuscan subjects, with the exception of the Jewish population, which amounts to about 7000 individuals, chiefly at Leghorn and Florence. Foreigners of other Christian communions are not only tolerated, but are allowed the exercise of their respective worship in chapels for the purpose at Leghorn and Florence, as well as their own burying-grounds. There are at Leghorn a chapel of the church of England, a German Protestant chapel, and a chapel of the Swiss and French reformed communion, and a Greek chapel of the Eastern church. The number of resident Protestants in Tuscany is between three and four thousand.

The church establishment of Tuscany consists of three archbishops (Florence, Pisa, and Siena) and seventeen bishops (Fiesole, Arezzo, Cortona, Pistoja, Pescia, San Miniato, Livorno, Volterra, Massa Marittima, Grosseto, Montepulciano, Sovana, Montalcino, Colle, Chiusi, Borgo San Sepolcro, and Pontremoli). The income of most of the sees varies between 4000 and 7000 dollars; a few have only 2000 dollars. There are many collegiate churches, besides cathedrals, and 2414 parishes. The total number of individuals in holy orders, exclusive of the monastic orders, was, in 1835, 8900; and the income of the beneficed clergy, derived from land and houses alone, amounted to 2,264,380 Tuscan livres, or about 80,000 pounds sterling. The produce of their other sources of income is not known. In 1808 the secular clergy of Tuscany numbered nearly 14,000 individuals.

The monastic clergy in 1835 numbered 2461 monks or friars, distributed among 133 convents, of which 81 are possessed of property, and 52 are of the mendicant orders and are supported by public charity. The income possessed by the former, derived from lands and houses alone, amounts altogether to 542,645 Tuscan livres, or about 18,000*l.*; but some of them have pensions assigned on the treasury. There are also 69 nunneries, with about 3900 nuns, having a total income from lands and houses of 594,581 Tuscan livres; and 54 conservatorj, or houses for female education attached to convents, under the direction of nuns, and possessed among them of a capital of nineteen millions of Tuscan livres.

The profession of the law is in high esteem, and it can boast of many distinguished individuals for general as well as professional learning. Among contemporary names we may mention Collini, Cantini, Baldasseroni, Paolini, Carmignani, Capei, Guerrazzi, and Rosini, who are all known as authors. A Tuscan advocate in good practice can make a thousand dollars a year; some realize much more.

The medical profession is also well studied; and the Universities of Pisa and Siena, and the Medical and Surgical College annexed to the great hospital of Santa Maria Nuova at Florence, give excellent instruction to students. Professors Grottanelli, Magheri, Betti, Uccelli, Nespoli, are well known among contemporary names.

For the purpose of general education there are grammar-schools ('scuole Latine superiori') at Florence, Figline in the Valdarno, Cortona, Castiglionfiorentino, Pietrasanta, Modigliana, and Livorno: they are kept by the Fathers Scholarum Piarum, and are attended by about 2500 students. The instruction is gratuitous. There are, besides, Collegi Convitti, or schools for boarders, as well as for day students, at Siena, Volterra, Arezzo, Prato, and Pistoja, attended by above 1000 students; mostly under the direction of the Fathers Scholarum Piarum, who are the chief instructors of the Tuscan youth, and who deserve great praise for their zeal and ability. In every diocese there is at least one clerical seminary for those who study for the church, and several of them also admit external or day students: the whole number attending these establishments is about 1500. Lastly, the two Universities of Pisa and Siena are attended, the former by about 550 students, the latter by about one-half that number. Each of these universities has four faculties, divinity, jurisprudence, medicine, and surgery, and the physico-mathematical sciences, and confer degrees in each of these faculties.

Female education is afforded by the 'Conservatorj,' or boarding-schools, which are directed by nuns. There is one or more of these establishments in every town. Several of them have at the same time a charity day-school for poor girls. In Florence and other principal towns there are educatorj, or houses of education attached to several convents for ladies of the higher classes, who have the assistance of able teachers and professors. That of 'l'Annunciata' at Florence is one of the best: it contains generally about one hundred pupils, and the expense of each to the parents is about 100*l.* sterling a-year, a high sum for Tuscany. Several noble families have adopted the system of domestic instruction for their daughters. An educatorio, called di Fuligno, for poor girls, has been established in Florence by the present grand-duke.

Gratuitous elementary schools for boys exist in almost every commune, and are supported from the local taxation. There are, besides, private elementary schools, some supported by benevolent individuals, and others paid by the pupils. In the principal towns, such as Florence, Livorno, Pisa, Siena, Prato, and Pistoja, there is an elementary school in every parish. There are elementary schools for girls in several towns. Those of Florence, Pisa, Siena, and Pistoja are styled 'normal schools,' and are supported chiefly by the public treasury. Florence alone has four of these, which are attended by 1100 girls.

Among the special schools we must mention the Academy of the Fine Arts at Florence, and the College of Medicine and Surgery attached to the hospital of Santa Maria Nuova in the same city.

The education of youths of noble families, a numerous, though usually not a very wealthy class in Tuscany, used formerly to be afforded at home under a generally inefficient and pedantic tutor, usually a poor country priest, but is now generally pursued at the colleges for the nobility, the principal of which is the Collegio Tolomei at Siena, directed by the Fathers Scholarum Piarum. Nobility however is far from being an exclusive caste in Tuscany, as there are numerous offices and professions which impart the rank of nobleman to the holder, though not to his children. The Tuscan nobility has produced in all ages men distinguished for learning, and for their patronage of learning, and the present generation is not behind in this respect, as is proved by the names of Marquis Ridolfi, a well-known agriculturist and promoter of education; of the Marquis Gino Capponi, a man of letters and a patron of learning; of Count Fossombroni, long prime minister of Tuscany; of the late Count Baldelli Boni, a well-known writer and others.

Owing to the diffusion of education, industry, and commerce, and to the thrifty habits of the people, and the subdivision of property, the middle classes are more numerous and have more influence in Tuscany than in other parts of Italy; the mercantile class enjoys great consideration, especially at Leghorn, and several merchants have been raised to the rank of noblemen by diplomas from the grand-duke.

Charitable institutions are numerous: there are about thirty-five hospitals for the infirm, fifteen foundling hospitals (the number of foundlings taken in yearly is about 2600), five orphan asylums, several 'case pie di lavoro,' or workhouses, twelve 'monti-di-pietà,' ten savings-banks, fourteen infant asylums, and numerous 'confraternite,' or societies of charitable persons who assist the sick poor, the prisoners, give portions to poor girls being married, afford instruction to children, distribute clothes and other necessaries to the indigent, and bury the dead. The Jewish population at Leghorn have their own charitable institutions and schools.

A society of shareholders has begun a railroad from Leghorn to Florence. The tract from Leghorn to Pisa was expected to be opened before now. Three Tuscan steam-vessels, two of 140 horse-power, ply along the coast of Italy between Naples and Marseilles.

The civil law in Tuscany is based upon the Roman and canon laws, and the principles of former decisions for ages past. A commission for the revisal of the civil law was appointed by the late grand-duke Ferdinand, and it framed several enactments which received the sanction of the sovereign, and which concern chiefly the successions of intestates, the law of paternal authority, and of guardianship and curatorship, the obligations of wives and minors, the forms and conditions of wills, and marriage-portions. The manner of civil proceeding resembles that of France. Leopold I. issued in 1786 a 'motuproprio,' or ordonnance on criminal law, to which his son and successor Ferdinand III. added another ordonnance dated 1795, both of which are in print. The first stage of the proceedings in criminal cases, called 'instruction,' is carried on, as in the Austrian states, in writing. Counsel is allowed to the accused, and the oral proceedings on the trial are public. Capital executions are very rare: the galleys are the common punishment for felonies. Death in duel is considered as wilful murder, and punished as such.

The ecclesiastical or episcopal courts have no criminal jurisdiction in Tuscany. They watch however over the conduct of the clergy, and in some cases may confine offending individuals of that body to a convent, with the previous sanction however of the 'Secretario del Regio Diritto,' who acts as minister of ecclesiastical affairs. Offences against the established religion are cognisable by the lay courts and police. Religious liberty is not allowed in Tuscany; but unless a person make himself conspicuous and offensive, his private opinions and practice in religious matters are not sought after. No inquisitorial court exists. Bulls from Rome have no power without the 'exequatur' of the government. With regard to vacant sees, the grand-duke proposes candidates and the pope appoints.

Foreigners in Tuscany are placed upon the same footing as natives; they can purchase, inherit, and dispose of property without any restrictions.

(Serristori, *Statistica dell' Italia · Almanacco della Toscana;* article on 'Education in Tuscany,' in No. 3 of the *Quarterly Journal of Education; Private Communication.*)

History of Tuscany.—A sketch of the antient history of the country is given under Etruria. Etruria extended southwards as far as the Tiber. After the fall of the Western empire, Etruria became a province of the kingdom of the Goths, and afterwards of the Longobards, under the name of Tuscia, Tusci having been used by the Romans as synonymous with Etrusci. Under the Longobards it was divided into 'Tuscia Regni,' which included the duchies of Luca, Florence, and Clusium, and 'Tuscia Longobardorum,' which comprised the duchy of Castro, the present papal province of Viterbo. Gradually the name of Tuscia, or Tuscany, became restricted to the former division only. Under Charlemagne and his successors Tuscany was administered by marquises, of whom the following is the series: Boniface I.; Boniface II., who gained a victory at sea over the African Saracens, A.D. 828, and effected a landing in Africa near Carthage; Adalbert I.; Adalbert II., styled 'the rich marquis;' Wido, the husband of the famous Marozia of Rome; Lambert, Boson, Hubert, Hugo, Tedaldus, and Boniface III., who was also Count of Mantua and Modena. Boniface III. being murdered near Cremona, A.D. 1052, his widow Beatrix married Godfrey duke of Lotharingia, or Lorraine. Beatrix died in A.D. 1076, and Matilda, her daughter by her first husband, inherited all the dominions of Boniface III. Her career is noticed under Gregory VII. She died A.D. 1115, leaving no issue, and the series of the marquises of Tuscany ended with her; for though the emperors of Germany as kings of Italy continued for a time to appoint imperial vicars in Tuscany, their authority was little more than nominal, as the republics of Florence, Pisa, Siena, Arezzo, Pistoja, and Lucca divided the country among them. The sequel is given under Florence, Pisa, and Siena (*History of*). Florence, having conquered Pisa, became the predominant power in Tuscany. The progressive encroachments of Florence are clearly traced on a map of Tuscany which Litta has appended to his biography of the Medici family, in his 'Famiglie celebri Italiane.' Sketches of the latter years of the Florentine republic are given under Leo X., Medici, and Strozzi. After the fall of the republic in 1530, Charles V. appointed Alessandro de' Medici, an illegitimate son of Lorenzo, duke of Urbino, to be duke of Florence. Alessandro proved an unprincipled, cruel, and dissolute tyrant. He was murdered by his cousin Lorenzino de' Medici, in January, 1537; but the party of the Medici, headed by Guicciardini, the historian, proclaimed Cosmo de' Medici, son of Giovanni, 'delle bande Nere.' Cosmo was the founder of the grand-ducal dynasty of Tuscany, having united Siena to his other dominions. [Cosmo I.]

1574. Cosmo died, and was succeeded by his son Francis I., who had the vices of his father without his abilities.

1587. Francis died without issue, and was succeeded by his brother Ferdinand I., who did much to restore industry and prosperity. He was the benefactor of Leghorn, and might be called the founder of that commercial emporium.

1609. Ferdinand died, and was succeeded by his son Cosmo II., who, assisted by his able minister, Picchena, followed in his father's footsteps. The military order of S. Stefano, instituted by Cosmo I., to defend the coast of Tuscany and cruise against the Barbary powers, obtained various successes at sea.

1621. Cosmo II. died, and was succeeded by his son Ferdinand II., then a minor. Ferdinand's administration was weak, and his long reign was an age of decline for Tuscany. His brother Cardinal Leopoldo de' Medici was a patron of the sciences.

1670. Ferdinand II. died, and was succeeded by his son Cosmo III. Under him the condition of Tuscany continued to decline.

1723. Cosmo III. died, and was succeeded by his son Gian Gastone, who was careless of his subjects, and given to debauchery.

1737. Gian Gastone died without issue, and with him ended the grand-ducal dynasty of Medici. He was succeeded, according to an agreement between the great powers, by Francis, duke of Lorraine and Bar, whose territories were given to Stanislav Leczinski, to revert to France after his death. Francis married the archduchess Maria Theresa, daughter and heiress of Charles VI. of Austria, emperor of Germany. Tuscany was governed by a regency, while Francis and Maria Theresa resided chiefly at Vienna.

1765. Francis II. of Tuscany and I. of Germany died. His eldest son Joseph succeeded him as emperor of Germany, and his second son Leopold succeeded him as grand-duke of Tuscany. The reign of Leopold I. will ever be memorable in the history of Tuscany as a period of revival of industry and prosperity, of improvement in every department of administration, of order, peace, and an enlightened legislation. A brief sketch of his administration is given under Leopold II. of Germany.

1790. Leopold having succeeded his brother Joseph II. as emperor of Germany and sovereign of the Austrian dominions, and his eldest son Francis being thereby hereditary prince of the Austrian monarchy, the grand-ducal crown of Tuscany devolved upon his second son Ferdinand III., who followed the wise and liberal system of administration pursued by his father. In the war of the French revolution he strove to remain neutral, and even concluded a treaty to that effect with the new French republic; but when Bonaparte invaded North Italy, in 1796, he disregarded the neutrality of Tuscany, and marched to Leghorn with a body of troops for the purpose of sequestrating all British property there. In consequence of this, the English occupied Porto Ferrajo in the island of Elba. The grand-duke however retained a precarious possession of Tuscany.

1799. The French Executive Directory ordered the occupation of Tuscany by its troops, and the grand-duke was obliged to withdraw to Germany. The people of Arezzo and the neighbouring districts rose in arms against the French, defeated several detachments of French and Polish troops, and took Cortona, Siena, and Perugia in the Papal state. In consequence of the many defeats of the French in Lombardy by Suvórov, the French troops evacuated Tuscany in July of the same year. A provisional government was established in the name of the grand-duke Ferdinand.

1800. In consequence of the victory of Marengo, the French re-entered Tuscany; and the people of Arezzo having resisted them, their town was stormed and pillaged.

1801. By the peace of Luneville between France and Austria, Ferdinand renounced Tuscany, which Bonaparte gave to Don Ludovico Bourbon, hereditary prince of Parma, with the name of 'kingdom of Etruria.' The island of Elba and the district of Piombino were given up to France.

1803. Ludovico died, and his widow, Maria Luisa of Spain, became regent of Tuscany in the name of her son, a minor.

1808. Napoleon took possession of Tuscany, and sent away the queen-regent and her son, promising them a compensation in Portugal. Tuscany was united to the French empire, of which it formed three new departments, Arno, Ombrone, and Mediterranée: Elise Baciocchi, Napoleon's sister, was placed at the head of the administration, with the title of grand-duchess.

1814. The grand-duchess Elise quitted Tuscany, which was occupied by the allied troops in the name of the old grand-duke, Ferdinand III., who returned to Florence in September.

1815. The Congress of Vienna confirmed the possession of Tuscany to the grand-duke Ferdinand and his successors, and annexed to it the whole of the island of Elba, and the Stato de' Presidj on the coast of Siena, to which were afterwards added the principality of Piombino, with other districts and fiefs. To Maria Luisa, ex-queen of Etruria, as guardian of her son, was assigned the duchy of Lucca, to revert to Tuscany on the death of the archduchess Maria Louisa of Austria, wife of Napoleon, and actual duchess of Parma, when the duchy of Parma and Piacenza shall revert to the present duke of Lucca.

1816. Ferdinand ordered the drainage of the Val di Chiana. Plantations were made, and roads and farmhouses constructed. The same process was afterwards pursued in the Val di Nievole for draining the marsh of Fucecchio between Pescia and the Arno.

1824. Ferdinand III. died, much regretted as a kind and liberal prince, and was succeeded by his son Leopold II. The new grand-duke has continued the system of progressive improvement with renewed activity by undertaking the great task of draining the marsh of Castiglione and other marshes which corrupted the atmosphere of the Maremme, opening new roads, embanking rivers, extending the privileges of a free port to the suburbs of Leghorn, supplying that important town with wholesome water by means of an aqueduct, and by other measures of like utility. At the same time he has reformed the judiciary administration, established new tribunals, has encouraged popular education as well as scientific instruction, and has issued several useful legislative and economical enactments. Tuscany is decidedly the happiest and quietest country in Italy, being that in which all classes, high and low, the rulers and the ruled, live together on the best terms, and in which a considerable degree of material comfort and intellectual refinement pervades the whole mass of society.

(Among the general historians of Tuscany we may quote Pignotti, *Storia della Toscana fino al Principato*; Galluzzi, *Storia della Granducato di Toscana sotto il Governo della Casa Medici*; Reumont, *Tavole cronologiche e sincrone della Storia Fiorentina*; and Zuccagni Orlandini, *Atlante geografico, fisico, e storico, del Granducato di Toscana*: for the literary history, Moreni, *Bibliografia Storica ragionata della Toscana*: for the geography and geology, Targioni Tozzetti, *Relazione di alcuni viaggi fatti in diverse parti della Toscana*; Santi, *Viaggi al Montamiata, e per le due Provincie Senesi*; and the *Atti*, or *Memoirs of the Academy dei Georgo fili*; Repetti, *Dizionario geografico-statistico della Toscana*.)

TU'SCULUM. [Frascati.]

TUSSER, THOMAS. The amusing poetical autobiography of this quaint writer, although it forms almost the only source of information respecting his personal history, is unfortunately deficient of dates. Warton supposes his birth to have taken place about 1523; but in the biography prefixed to Dr. Mavor's edition of his book it is shown from several circumstances that 1515 is a more probable date. He was born at Rivenhall, near Witham, in Essex, of a family which is recorded as bearing arms in the heralds' visitation in 1570: he was taught singing at an early age, and became a chorister in the collegiate chapel of Wallingford Castle, from which place he was removed by impressment, according to a barbarous custom formerly existing, by which boys might be forcibly removed from any choir for the service of the royal chapel. After being for some time compelled, as he says, 'to serve the choir, now there, now here,' he was admitted into St. Paul's, where he profited by the instruction of John Redford, then organist of that cathedral. From St. Paul's he went to Eton, where he experienced some severity from the master, Nicholas Udall. He subsequently removed to Cambridge; after which he returned to court, and appears to have been a retainer in the family of William lord Paget. When he had spent ten years at court, probably engaged in his musical capacity, he married, and became a farmer at Katwade, now Cattiwade, in Suffolk, where he wrote his celebrated work on husbandry, of which the first edition appeared in 1557, entitled 'A Hundreth Good Pointes of Husbandrie.' After several other changes of residence, and marrying a second time, Tusser returned to London, whence, about 1574, he went to Trinity College, Cambridge; in order to escape from the plague. He is supposed to have returned to London, where he died about 1580, or between that year and 1585. After passing through several editions, his work appeared in an enlarged form in 1573, under the following title: 'Fiue Hundreth Points of Good Husbandry, vnited to as many of Good Huswiferie,' &c., 'Set forth by Thomas Tusser, gentleman, seruant to the honourable Lord Paget, of Beudesert.' This work was many times reprinted, with various alterations; but most of the early editions are rare, probably on account of the copies being worn out with frequent use. Dr. Mavor reprinted it in 1812, together with a list of all the known editions, and such information as he could collect respecting the author. Fuller says of him, in his 'Worthies of Essex,' that he 'was successively a musician, schoolmaster, serving-man, husbandman, grazier, poet, more skilful in all than thriving in any vocation. He traded at large in oxen, sheep, dairies, grain of all kinds, to no profit. Whether he bought or sold, he lost; and, when a renter, impoverished himself, and never enriched his landlord.' 'Yet,' he adds, 'hath he laid down excellent rules in his book of husbandry and huswifery (so that the observer thereof must be rich) in his own defence.' It is written in familiar verse, in numerous detached chapters, and with much variety of measure; and it is, as observed by Warton, who styles Tusser the British Varro, 'valuable as a genuine picture of the agriculture, the rural arts, and the domestic economy and customs of our industrious ancestors.' The life of the author, which forms by no means the least amusing part of the book, appears to have been first printed with the edition of 1573.

TUSSILA'GO (from *tussis*, 'a cough'), a genus of plants belonging to the natural order Compositæ. It has a simple involucrum, formed of a row of equal linear scales; the flowers of the head, of different sexes; the flowers of the margin female, ligulate, entire; the flowers of the disc hermaphrodite, tubular, 5-toothed; the stigmas linear; the receptacle naked; the pappus simple. The species are natives of Europe and America. Two are natives of Great Britain.

T. Farfara, Common Coltsfoot, has a single-flowered scape imbricated with scales, and cordate angular leaves, toothed, and downy beneath. This plant is a native of moist, chalky, clayey situations throughout Europe. Its flowers come up in March and April, and have often disappeared before the leaves ascend from the ground. Dr. Sibthorp found this plant in Greece, and believes it to be identical with the βήχιον of Dioscorides. It derives its specific name, *Farfara*, from its leaves resembling those of the white poplar, which was called *Farfarus* by the Greeks. This plant from the earliest times has had a great reputation for curing coughs: hence its generic name. The part used is the leaves, which are very large, and clothed on the under surface with a dense white cottony down. They are mucilaginous, astringent, and slightly bitter, and are used either in infusion or decoction, or dried and smoked like tobacco. The downy cotton may be scraped off from the bottom of the leaves, and when dipped in a solution of saltpetre and dried, it makes excellent tinder. The plant is not often used now by the medical practitioner. It has still however a popular reputation, and it is reputed to be the basis of several quack medicines. In its wild state it is remarkable for growing where no other plant is to be found, especially on newly turned-up heavy clay soils. In these situations it has sometimes led to the inference that its seeds were contained in the earth, and germinated when thrown to the surface. It seems however more probable that as the fruit of the coltsfoot is furnished with a pappus that enables it to pass through the air, the seeds have thus been conveyed to the place where they have found a fit soil for their development.

T. Petasites, Common Butter-bur, has a dense oblong thyrse, with cordate unequally toothed leaves, downy beneath, and the lobes approximate. The plant is very abundant in wet meadows and by river sides. It has long creeping roots, by means of which it is rapidly and extensively reproduced, and is a great pest in moist meadows, where it delights to grow. Like the last species, it puts forth its flowers in April and May before its leaves. On account of its early flowering, the Swedish farmers plant it near their bee-hives. Dr. Sibthorp found this plant in Greece, and believed it to be identical with the Petasites (πετασίτης) of Dioscorides. This is the specific name of the plant, and comes from *petasus*, a broad covering for the head. This plant produces the largest leaves of any in Great Britain, sometimes measuring three feet broad. The butter-bur was at one time supposed to be a remedy of value in the plague, from which it has got the name Pestilent-wort. This species has been made a genus, under the name *Petasites*, by Gærtner, who is followed by Cassini, Desfontaine, and others. It is distinguished from the genus *Tussilago* by its involucre having two rows of lanceolate scales, by its flowers not being radiant, and by its scapes being many-flowered.

T. fragrans, Fragrant Coltsfoot, has a fastigiate thyrsus, radiant heads; roundish, cordate, unequally-toothed leaves, and downy beneath. This plant blossoms early, and has a sweet scent, and has found very generally a place in gardens. It is a desirable flower where bees are kept.

When these plants are cultivated, they may be propagated by seeds, which should be sown in spring, but not at too great depth. They may be also propagated by parting the roots. On account of the rapidity with which they increase themselves by their roots, they should be planted in gardens in pots, otherwise they may become difficult to get rid of. Most of the species send up their flowers before their leaves, and are placed with others by gardeners in a class called 'filius ante-patrem.'

TUSSILA'GO FA'RFARA (Coltsfoot), a perennial plant belonging to the order of compound plants, common in damp, clayey fields, road-sides, and the banks of rivers, the yellow flowers of which are seen in spring preceding the nearly heart-shaped, smooth-toothed leaves, which, from their resemblance to a young horse's hoof, have received the popular name of coltsfoot. The whole plant is nearly devoid of odour. The root has a styptic bitter taste; the leaves and flowers are bitter and mucilaginous. The chief constituents are mucilage, bitter extractive, tannic acid, colouring-matter, salts, and woody fibre. The watery infusion becomes of a dark green and turbid appearance on the addition of a solution of sesquichloride of iron. Its properties may easily be inferred from the above statement; they are demulcent, slightly astringent, tonic, and expectorant. Its name both in Greek (βηχιον) and in Latin proves the estimation in which it was held as a means of relieving cough—a reputation which it does not maintain in modern times among professional observers, except a very few; but with the vulgar it is still in great esteem. The antients smoked it rather than used it in any other form; and in the north of Europe, and even with our own vulgar, this mode is employed, what is sold under the name of British Herb Tobacco being chiefly coltsfoot. This at least is harmless; not so the nostrum called Essence of Coltsfoot, which is a combination of balsam of tolu, compound tincture of benzoin, with a large quantity of rectified spirit of wine, and not a particle of the substance from which it takes its name. In chronic coughs accompanied by much local or general irritation, still more in genuine tubercular consumption, such heating ingredients must be very hurtful; though a plain decoction of real coltsfoot would be unobjectionable, and might be beneficial. The leaves of coltsfoot form, when moistened with warm water, an excellent emollient poultice.

TUTBURY. [STAFFORDSHIRE.]

TUTE'LA. [TUTOR.]

TUTENAG, an alloy used in China in the manufacture of the *gong;* it is white, resembling silver in appearance, and is very sonorous when struck. Its specific gravity was found by Dr. Fyfe to be 8·432; it is susceptible of a fine polish, and does not readily tarnish; at common temperatures, and even at a red heat, it is malleable, but when heated to whiteness it is rendered brittle.

It has been analysed by Dr. Fyfe, who found it to consist of—

Copper . . .	40·4
Zinc . . .	25·4
Nickel . . .	31·6
Iron . . .	2·6
	100·

German silver, which is now extensively used as a substitute for silver, is also an alloy of copper, zinc, and nickel.

TU'TILO, a celebrated monk of the latter part of the ninth century, of the convent of St. Gall in Switzerland. Tutilo and Notker, of the same convent, were the most celebrated painters, sculptors, and goldworkers of their time in Germany. Tutilo was a universal genius, and not only an artist: he was musician, poet, orator, and statesman. Ekkehard, junior, an old German Latin writer, thus describes him:—'Erat enim valde eloquens, voce clara et dulci, caelaturae elegans, picturae artifex, ac mirificus aurifex, musicus,' &c. The emperor Charles the Thick complained that such a man should be shut up in a convent.

Tutilo was contemporary with the abbot Salomo of St. Gall (891-921), who was a great patron of the arts, and he made for him a golden crucifix, richly ornamented with bas-reliefs and precious stones. He made also a celebrated sitting image of the Virgin Mary, in gold, for a church at Metz, by which he acquired great celebrity: it bore the inscription, 'Hoc panthema pia caelaverat ipsa Maria.' One account says painted. This image or painting was venerated at Metz. In the church of St. Otmar, also at St. Gall, the altar of St. Gall was decorated with some copper plates, on which the life of the saint was engraved or carved by Tutilo. He is said to have died in 896, and this date is twice repeated by Fiorillo; yet he calls him a monk of the tenth century. Other writers also call him a monk of the tenth century. Lessing and some others have supposed that Tutilo, or Tuotilo, as his name is also written, and the Theophilus Presbyter who wrote a treatise in Latin upon oil-painting and other arts in or about the tenth century, were the same person. There are manuscripts of this old treatise, more or less complete, at Wolfenbüttel, Leipzig, Paris, and at Cambridge. An exact copy of the Wolfenbüttel MS. was printed in 1781 at Brunswick, in the sixth number of Lessing's 'Beiträge zur Geschichte und Litteratur.' The treatise is in three books, and is known under the title 'Theophili Presbyteri Diversarum Artium Schedula;' also 'De omni Scientiâ Artis Pingendi;' but it treats of other arts besides painting. The authenticity of this work has been doubted by some, who have confounded the invention of Van Eyck with that of simply using oil as a vehicle for pigments. This subject has been entered into at length by Raspe, in a 'Critical Treatise on Oil-Painting,' published in London in 1781, and recently by Knirim, in a work entitled 'The Resin-Painting of the Ancients'—'Harzmalerei der Alten,' Leipzig, 1839. Various old notices of Tutilo are printed in the 'Rerum Alemannicarum Scriptores,' &c. of Goldast.

TUTOR. By the Roman law a male under the age of fourteen, and a female under the age of twelve, were called impuberes. A male who was impubes was incapable of doing any legal act by which he might be injured; and if he had no father, his property was under the care of a tutor, who was so called from his office of defending or protecting the impubes (tuendo) in the transactions which were necessary for the administration of his property. The office of the tutor was tutela; and the impubes, who with respect to his tutor was called pupillus, was said to be in tutela, in tutelage. The tutor's business was to manage the property of his pupillus, and to add to his acts the legal sanction (auctoritas). The tutor's office as tutor was confined to the property of his pupillus, who, as to his person, was under the care (custodia) of his mother, if he had one; if not, we must suppose that the tutor would sometimes have the care of his person also. When the pupillus attained the age of puberty, he had the capacity of contracting marriage, and of doing other legal acts, and was freed from the control of his tutor. But though the law gave full legal capacity to the pupillus on his attaining puberty, it still gave him some further protection until he was twenty-five years of age, and thus there arose a division of persons into those who were above and those who were under twenty-five. Accordingly a person under twenty-five years was often called Minor, and though he had attained puberty, he was under the protection of a curator, whose office was called curatio. The object of this institution was to protect minors against fraud (dolus), and it was originally effected by a lex called Lex Plaetoria, the date of which is uncertain, but it is at least as old as the time of Plautus. The subject of the curatorship is fully discussed by Savigny in a valuable essay (*Zeitschrift für Geschichtliche Rechtswissenschaft*, band x.). Women who had attained puberty were still under a special kind of tutela; but males, as already stated, were on the attainment of puberty completely freed from the control of a tutor. [CURATOR.]

A father could appoint by testament a tutor for his male children who were impuberes and in his power; he could also appoint a tutor for females who were in his power, even if they had attained puberty. He could also appoint a tutor for the wife of a son, who was in his power, and for his grandchildren, unless by his death they should come into the power of their father. A man could also appoint a tutor for his wife, who was in manu, for she stood to him in the legal relation of a daughter; and he could also give her the power of choosing a tutor. The origin of this testamentary power was probably immemorial custom, which was confirmed by the Twelve Tables. Tutors thus appointed were called dativi: those who were chosen by a wife under a power given by the husband were tutores optivi. If a testator appointed no tutor, the tutela was given to the nearest agnati by the Twelve Tables: such tutores were legitimi. If there were no agnati, the tutela belonged to the Gentiles so long as that part of the law (Jus Gentilitium) remained in force. By analogy to the case of the tutela of ingenui (persons free by birth), the tutela of liberti and libertæ belonged to their patrons. When there was no person appointed tutor, and no legitimus tutor existed, a tutor was appointed for persons at Rome under the provisions of a Lex Atilia, and for persons in the provinces under the provisions of a Lex Julia et Titia.

It is a consequence of the rules laid down as to the power of appointing a tutor, that none but persons who were sui juris could exercise this power; and accordingly women and some other classes of persons could not appoint a tutor.

As already stated, a pupillus could not do any legal act which should be to his injury; but he could enter into contracts which were for his benefit. The tutor's office was defined to consist in doing the necessary acts for the pupillus, and interposing or adding the legal authority to his proper acts (negotia gerere et auctoritatem interponere: Ulpiani *Frag.*, tit. xi., s. 25). The doing of the necessary acts applied to the case of the pupillus being infans, that is, under seven years of age, absent, or lunatic (furiosus). When the pupillus ceased to be infans, he could do many acts himself, and the auctoritas of the tutor was only necessary to make them legal acts.

A tutor might be removed from his office if he misconducted himself in it. The pupillus had also an action against him for mismanagement of his property. The tutor was allowed all proper costs and expenses incurred by him in the management of the affairs of the pupillus; and he could recover them by action. Security was required by the praetor from a tutor for the due management of the affairs of a pupillus, unless he was a testamentary tutor, for such tutor was chosen by the testator, and, generally, unless he was appointed by a magistratus, for in such case he had been selected as a proper person.

The tutela of women who were puberes was a peculiar Roman institution, founded on the maxim that a woman could do nothing without the auctoritas of a tutor. But there was this difference between the tutela of pupilli and of women who were puberes: in the case of pupilli the tutor both did the necessary acts, particularly when the pupillus was infans, and gave his auctoritas; in the case of women who were puberes, the tutor only gave his auctoritas.

The Vestal virgins, in virtue of their office, were exempted from tutela. Both libertinae and ingenuae were exempted from it by acquiring the Jus Liberorum, which was conferred by the Lex Julia et Papia Poppaea on women who had a certain number of children. The tutela of a woman was terminated by a marriage, by which she came in manum viri; and also by other means.

A woman had no right of action against her tutor as such, for he did not do any act in the administration of her property: he only gave to her acts their legal validity by his auctoritas.

The subject of the Roman tutela is one of considerable extent, and in the case of women it involves some difficult considerations. The matter is more fully discussed, by the writer of this article, in the 'Dictionary of Greek and Roman Antiquities,' where the authorities are referred to.

TUTSAN, the name of a plant indigenous to Great Britain. This plant was included by Linnæus under the genus *Hypericum*, with the name *H. Androsæmum*, but it has been separated by Allioni, and made itself the type of a genus, under the name *Androsæmum officinale*. Androsæmum differs from Hypericum in its fruit being a berry, and having but one cell. *A. officinale* has three styles; a shrubby compressed stem, two feet high; unequal sepals; large ovate sessile leaves. The flowers are large and arranged in cymes. The berry is black, and when squeezed in the fingers gives out a blood-coloured juice; hence the name Androsæmum, or 'man-blood' ἀνδρός, αἷμα). The English name Tutsan is derived from *toute saine*, French, a term employed on account of its bruised berries having been employed as an application to recent wounds: a custom which arose out of the supposition that nature had pointed out the use of these berries by their bloody colour.

Tutsan is found in damp places throughout Europe, but is not an abundant plant. In Great Britain its distribution is very local. It occurs abundantly in some parts of Norfolk and Hertfordshire, and is not unfrequent in Ireland and the west of Scotland.

TUTTY. [ZINC.]

TUXFORD. [NOTTINGHAMSHIRE.]

TUY, a district and bishopric of Galicia in Spain, comprising eight parishes. The capital, Tuy, is the antient Tude mentioned in the Antonine Itinerary. It is situated in a fertile plain watered by the Miño, and three other smaller rivers which empty into it. Tuy was a city of some importance under the Goths. It was taken and destroyed by the Arabs; but about a century after the foundation of the kingdom of Asturias by Pelayo, Ordono I. rebuilt it. Destroyed a second time by the Arabs, it was again rebuilt some time after by Fernando II. of Leon, on the site which it occupies at present. The castle, and a palace, which is now inhabited by the bishop, were also erected by that king. Tuy is surrounded by an antient wall flanked by square towers at intervals. The cathedral, which is in the Gothic style, is not a striking building. The environs of Tuy are well cultivated, and planted with vines, oranges, lemons, and other trees and plants of more southern climates; besides hemp and flax, which constitute the chief production of the surrounding country. The population of Tuy amounted in 1826 to something more than 6000. (Miñano, *Diccionario Geográfico de España y Portugal.*)

TUY, LUCAS DE, or LUCAS TUDENSIS, a celebrated Spanish historian, so named because he was bishop of Tuy, lived in the thirteenth century, and was probably a native of Leon. While deacon, the devotion of the age led him to Rome, Constantinople, and Jerusalem; and on his return he distinguished himself by his writings against such of his countrymen as had embraced the religious opinions of the Albigenses. It was probably to his zeal in this cause that he owed his appointment to the see of Tuy. He died in 1250. He wrote a Latin chronicle entitled 'Chronicon Mundi,' which appeared for the first time at Frankfort, in the fourth volume of Scott's 'Hispania Illustrata.' The style of this work, which ends with the reduction of Cordova in 1236, is not bad, though it is often abrupt; but the book is valuable, as it contains many facts which escaped other historians before Lucas. 'De Alterâ Vitâ Fideique Controversis adversus Albigenses:' this was printed at Monaco, and also at Ingolstadt, in 1612, 4to. Lucas is also said to have written a Life of St. Isidorus, and to have translated into Spanish the History written by that prelate. (Nicolaus Antonius, *Bib. Hisp. Vetus*, lib. viii., cap. 2 and 3; Florez, *España Sagrada*, vol. xxii., p. 108.)

TWEDDELL, JOHN, was born on the 1st of June, 1769, at Threepwood near Hexham in Northumberland, where his father Francis Tweddell was a much-respected magistrate. His early education was conducted by his mother, who is much praised for her piety and maternal affection. At the age of nine he was sent to a school at Hartford near Richmond in Yorkshire, which was then conducted by the Rev. Matthew Raine, who watched and directed the studies of young Tweddell with anxious care. After he had left school, and before entering the university of Cambridge, he studied for some time under Dr. Samuel Parr, who made his pupil familiar with the best writers of antiquity, and at the same time secured his permanent esteem and attachment. Tweddell gained the highest classical honours in the university of Cambridge; and in 1792 he was elected a fellow of Trinity College. His 'Prolusiones Juveniles,' which he published the year after (1793), show the extent and versatility of his powers, and raised at the time great expectations of the young scholar. His own inclination would have led him to devote himself to classical learning, or, as some of his letters suggest, to a diplomatic career, but his father wished that he should study the law; and although this profession was altogether against his taste, yet, in deference to his father, he entered the Middle Temple. Here he devoted himself to his new pursuits with as much application as his aversion to them would allow him. At last however he seems to have been unable to continue his studies, and made up his mind to travel for some years in order to prepare himself for a different course of life, and to acquire a knowledge of the courts of Europe and their several systems of policy. Accordingly he embarked for Hamburg on the 24th of September, 1795. He travelled through the north of Europe, Switzerland, and thence eastward into Asia, where he visited among other parts the Crimea and the coasts of the

Euxine. Thence he proceeded to several islands of the Archipelago, and to Athens, where he took up his residence for some months. With the most ardent zeal he explored and described the remains of antient art and architecture, and employed a distinguished French artist of the name of Preaux in making drawings for him. But in the midst of these pursuits he died, on the 25th of July, 1799, after a short illness, and was buried within the precincts of the temple of Theseus. A monument was erected on his grave, with a Greek inscription, by the Rev. Robert Walpole.

During the whole time of his travels Tweddell kept a diary, in which he recorded everything remarkable he met with, intending on his return to England to publish an account of his travels, together with some of the drawings made by Preaux. After his death his friends accordingly made all possible efforts to get his effects, MSS., and drawings over to England. A great number of MSS., together with upwards of 300 highly finished drawings, were actually forwarded from Athens to Constantinople, and intrusted to the care of the English ambassador there, but nothing ever reached this country, and all investigations that have been instituted by the friends of Tweddell have remained without any result. The whole matter is still a mystery. The only memorial which remains of his travels is a number of letters addressed to his friends in England, which were published by his brother the Rev. Robert Tweddell, under the title 'Remains of the late John Tweddell, &c., being a Selection of his Letters from various parts of the Continent, together with a re-publication of his "Prolusiones Juveniles,"' London, 1815, 4to. This collection of letters is preceded by a memoir of the author, by his brother Robert, who has drawn a most charming picture of the amiable, pure, and modest character of his brother, which is perfectly borne out by the spirit that pervades these letters. Respecting the loss of the MSS. and drawings, and all that was said about the matter at the time, see the *British Critic*, vol. v.

TWEED. [BERWICK; BERWICKSHIRE.]

TWEEDMOUTH. [BERWICKSHIRE.]

TWELVE TABLES. The Roman writers speak of the Twelve Tables under various names: they call them Leges Decemvirales, Leges XII Tabularum, sometimes simply Lex, the Law, as being pre-eminently the foundation of Roman Law; and by other names. After some struggle between the patricians and the plebs, a plebiscitum was passed (B.C. 454) with the assent of the senate, in pursuance of which three commissioners were sent to Athens and other Greek states to inquire about their legislation. The commissioners returned in B.C. 452, and in the following year ten patricians (Decemviri) were appointed to draw up a code of laws, whence the name Leges Decemvirales. The Decemviri, at the head of whom was Appius Claudius, formed a code of Ten Tables, which were approved by the senate, and received the final sanction of the Comitia Curiata. The code being considered defective, Decemviri were again elected (B.C. 450), and two more tables were added, whence the name Twelve Tables. The laws were cut on tablets of bronze and set up in a public place: they were not promulgated till B.C. 449, after the overthrow of the Decemviri, who had attempted to perpetuate their power against the terms of their appointment.

It is impossible to ascertain from the scanty history of the Decemviral legislation what the commissioners brought back with them from the Greek cities, or how far the codes of the Greeks affected this the first Roman attempt to form a system of law. Greek legislation might serve as a model for the form, but not for the substance; and it may safely be assumed that the basis of the Decemviral code rested on the customary law of the Romans. It is said that the Twelve Tables perished in the destruction of the city by the Gauls, but there appears to have been no difficulty in reconstructing the tables. No Roman writer suggests any doubt of their genuineness.

The Twelve Tables are called by Livy (iii. 34) 'Fons publici privatique juris—the source of Public and Private Law,' according to a division of the matter of law which was familiar to the Romans. That part which concerned the Jus Publicum, which bears some analogy to our term constitutional law, was changed in the course of time; but the Jus Privatum, which determined the rights and duties of the citizens was never formerly repealed, and only so far modified as it was affected by the changes in circumstances by which some of the laws of the Twelve Tables fell into desuetude, and by the gradual growth of the Jus Praetorium. They were altered however, in one instance at least, as we know by the abolition of the Legis Actiones by two Juliae Leges and a Lex Aebutia. In course of time the language of the tables became obscure, and this, with the great change of circumstances, must have rendered many of their provisions inapplicable. In the later times of the republic, Cicero observes that since his boyhood the practice of learning the Twelve Tables had been superseded by the growing importance of the Edict.

The Roman jurists made commentaries on the Twelve Tables. Six books of a commentary by Gaius are mentioned, which shows that at least as late as the time of Antoninus Pius the decemviral law was in substance still in force, that is, that the fundamental principles of Roman law (the Jus Privatum) were still to be sought in the then antiquated language of the Decemviri.

Much has been written on the subject of the Twelve Tables. The last and most complete history of the labours of modern critics on the Twelve Tables is by Dirksen, in his 'Uebersicht der bisherigen Versuche zur Kritik und Herstellung des Textes der Zwölf-tafel Fragmente,' Leipzig, 1824. The fragments of the Twelve Tables appear in the several parts of the work, and are also collected at the end.

TWER, one of the governments of Great Russia, is situated between 56° and 58° 47′ N. lat., and between 31° 46′ and 38° 20′ E. long. It is bounded on the north and north-west by Novogorod, on the east by Yaroslaw, on the south-east by Wladimir, on the south by Moscow, on the south-west by Smolensk, and on the west by Pskow. The area is 23,500 square miles. This government, especially the northern part, is an elevated table-land; there are no mountains, for the Wolkonsky forest, which covers the greater part of the circle of Ostuschkow, is but a range of hills, in which however many rivers have their source, among which is the Volga. This chain rests on limestone, and consists almost entirely of an impenetrable forest, in which there are extensive morasses, some offsets extend into the neighbouring country, which are scarcely more elevated than the banks of the river. Besides the Volga, which becomes navigable before it passes into the government of Yaroslaw, there are numerous rivers, the chief of which are the Dwina, the Wasuga, the Twerza, the Sestra, the Soscha, and the Mologa. The canal of Wyschnei-Wolotschok unites the Volga and the Neva, thus effecting a communication between the Baltic and the Caspian. There are some large and many small lakes; the most considerable is the Seliger, which is 24 miles long and 4 wide. The climate is healthy. The weather however is very variable, and the sudden changes are often injurious to the crops. The rivers generally freeze by the beginning of December and thaw towards the end of March or the beginning of April. Agriculture is the general occupation of the inhabitants, but the soil is poor and requires to be manured every year, so that the produce is scarcely more than sufficient for the home consumption; and it is often necessary to get corn from the neighbouring governments. Rye, barley, and oats are cultivated, but little wheat. Much flax and hemp are grown. Garden vegetables are everywhere produced, but only turnips, carrots, and cabbages are plentiful. Fruit does not thrive, and is scarce. Timber is very fine and abundant. There is little game for the table, but many bears, wolves, foxes, badgers, and martens. Fish are very plentiful. The population is probably now 1,300,000, consisting almost wholly of Russians. The chief occupations of the people are agriculture and the breeding of cattle, there being no manufactures except in the towns. Many hands are employed in the country in the sawing-mills, brick-kilns, ship-building, and in land and water carriage. The geographical situation of the government and its excellent inland navigation not only afford the greatest facilities for exporting its natural productions, corn, hemp, flax, timber, and cattle, besides some linen and leather, but favour the transit trade between the southern provinces and the Baltic ports and St. Petersburg.

TWER, the capital of the government, is situated in 56° 52′ N. lat. and 35° 48′ E. long. It stands on the right bank of the Volga, over which there is a bridge of boats in the summer: the Volga is here joined by the Twerza and the Tmaka, the former on the north, the latter on the south-west. Twer is an open town merely surrounded with palisades, which are closed by barriers, and consists of three parts: the fortress lying between the Volga and the Tmaka, which is surrounded with a rampart; the city, which is divided by the rivers into four parts, united by three bridges; and the suburb. Since its foundation in 1182 it has frequently suffered from war and pestilence. After a great fire in 1763, which reduced it to a few houses, the empress Catherine II. caused it to be rebuilt, and it is indebted to her for its present regularity and handsome appearance; it was likewise greatly improved during the residence of Prince George of Oldenburg, governor of Twer, Novogorod, and Wladimir, husband of the grand-duchess Catherine, and sister to the emperors Alexander and Nicholas. 'After the death of this prince its prosperity declined, and at present,' says Schnitzler, 'the houses bear marks of decay.' There are in the city a cathedral, twenty-eight churches, two convents, the bazaar—a large building containing 400 shops, the palace, a theatre, a foundling asylum, an hospital, and various establishments for education, among which are a gymnasium, a school for 120 young noblemen, an ecclesiastical seminary for 700 students, who are instructed in the sciences and the classics. Twer has 24,000 inhabitants, who have manufactures of linen, leather, hardware, candles, and carry on an extensive trade.

(Hassel, *Handbuch*; Stein, *Lexicon;* Schnitzler, *La Russie, la Pologne, et la Finlande.*)

TWILIGHT, the name given to the light which remains after the sun has set, or which is seen immediately before it rises. The reason of this appearance is explained in Sun (p. 281), being the effect of the light which is reflected from the higher strata of the atmosphere, in a manner which will be understood from the diagram in the page cited.

The twilight begins or ends at the time when the sun is at a certain depression below the horizon, which depression must depend upon the state of the atmosphere for the time being. In the fogs of winter darkness comes on almost immediately after sunset, while on a clear summer-evening the broad light of day will continue for more than an hour, in our latitude. We do not know, then, what we are to understand by the assertions made in astronomical books, some of which say that twilight lasts until the sun is 15 degrees below the horizon, others 18 degrees, and so on. And, first, they do not tell us how much light constitutes twilight: is it twilight only as long as a man with tolerable eyesight can see to read? or must that name be applied to the state of things as long as there is any vestige of daylight left? What is the test of the existence of this twilight? Perhaps it is to the vagueness of the definition that we owe such a number of descriptions of the duration of this partial day. Dr. Hutton informs us that Alhazen considered it to last until the sun is 19° below the horizon, Tycho Brahé 17°, Rothman 24°, Stevinus 18°, Cassini 15°, Riccioli 16° and 20½° in the morning and evening of the equinox, 21° 15′ at the summer solstice, and 17° 15′ at the winter solstice. 'Whence,' Hutton argues, 'it appears that the cause of the twilight is variable.' It is more likely that the variation was in its definition. He assumes, with Long, 18° as a proper medium in our latitude. Lambert assumed only 6½° as the depression of the sun below the horizon with which twilight ends. According to those who describe tropical climates, there is hardly any such thing as twilight; as soon as the sun has descended below the horizon darkness sets in almost immediately. Now, at the equator, even taking Lambert's angle of twilight, this phenomenon should last nearly half an hour. But the truth is, that the transition from light to darkness very much depends upon the rapidity with which it is made. Let a person go out of glaring sun-light into a room which is no darker than the open air will be an hour after sunset on the evening of the same day, and he will not at first be able to see to read; but let him sit at his book while the sun goes down, and he will find that he can read long after the degree of darkness just mentioned has been attained. In the tropics, where the sun falls down, as it were, upon the horizon, the changes are made very rapidly, and the consequence is that darkness comes upon the eye even more rapidly; while, in our latitude, the sun approaches more obliquely to the horizon, and continues to move obliquely after it has set, giving time to the pupil of the eye to accommodate itself to the diminished quantity of light. The meteorological state of the atmosphere varies so much from evening to evening, that the mathematical definition of twilight, namely, the interval which elapses from sunset to the attainment of a given depression below the horizon, is totally useless, be that angle of depression what it may. It is, in fact, one angle for one evening and another for another, according to the weather.

If twilight, mathematically considered, be an unknown quantity, it might still be made useful in warning the weatherwise not to place so much reliance as they do upon another mathematical result, the shortest day. If the atmosphere produced no effect, the day of the winter solstice would certainly be the shortest. But it is to be remembered that the day of which people usually speak means sunlight and twilight put together: a bright Christmas followed by a foggy spring will change the place of the shortest day very materially, by diminishing the twilight of the latter.

The mathematical consideration of twilight, upon an assumption as to the degree of depression of the sun at which it ends, will be found in all books of astronomy.

TWINING, THOMAS, was the only son of a tea-merchant by his first wife, and born in 1734. His father wished his son to succeed him in his business, but as Thomas had an invincible desire to devote himself to study, his father gave way to him and sent him to Cambridge, where he entered Sidney College. Here he distinguished himself not only as a scholar, but by his practical as well as theoretical knowledge of music: he was an able performer on the harpsichord, the organ, and the violin, and few persons knew more about the history and science of the art than Twining. In 1760 he took his degree of B.A., and three years later that of A.M. In 1768 he became rector of White Notley in Essex, to which, in 1770, the living of St. Mary, Colchester, was added. To this latter appointment he was presented by Dr. Lowth, then bishop of London, without any other recommendation than that of his personal character. Henceforth he devoted himself without any desire of further preferment to the faithful discharge of his parochial duties and to the pursuit of study, until his death, on the 6th of August, 1804, at the age of seventy.

Twining was a man of considerable learning and of great taste in the arts, especially poetry and music. He had a good knowledge of the antient languages, and is said to have spoken and written French and Italian with the same correctness and fluency as his mother tongue. In the performance of his clerical duties he was most conscientious, and during the last forty years of his life he scarcely ever allowed himself to be absent from his parishioners more than a fortnight in a year, although his society was very much courted. The only work that Twining ever published is a translation of Aristotle's 'Poetics,' which is reckoned one of the best English translations of antient writers. It was published under the title 'Aristotle's Treatise on Poetry translated, with Notes on the Translation and on the Original; and two Dissertations on Poetical and Musical Imitation,' London, 1789, 4to. A second edition, with some improvements and additions by the author, was edited by his nephew, Daniel Twining, London, 1812, 2 vols. 8vo. His notes and dissertations are worthy of the attention of every one who studies the theory of poetry and music. (Compare *Gentleman's Magazine*, vol. lxxiv.)

TWINING, WILLIAM, was born in Nova Scotia, and passed the early part of his life there, serving an apprenticeship to Dr. John Halliburton, a medical practitioner at Halifax. His medical education was completed in London, and, after becoming a member of the College of Surgeons, he entered the medical department of the army in 1812. After being employed for some time in the military hospital at Hilsea, he served for a short time in the Peninsula, and in 1815, after another service at Hilsea, joined the army in the Netherlands, and returned with his regiment in 1818. He remained in England, doing duty at different stations, till 1821, when he went to Ceylon, and after residing there for a short time, accompanied the governor, Sir Edward Paget, to India. In 1823 he was placed, at his own request, on half-pay, and in 1830 he resigned his commission, and entered into private practice at Calcutta, where he was appointed one of the surgeons to the civil hospital, and died in high reputation and esteem in 1835.

Mr. Twining wrote numerous papers in the 'Transactions of the Medical Society of Calcutta,' of which he was secretary, and one of the most active members, and other short essays; but his chief work was his 'Clinical Illustrations of the more important Diseases of Bengal, with the result of an Enquiry into their Pathology and Treatment,' Calcutta and London, 1832 and 1835, 2 vols. 8vo. He was recommended to undertake this work by the heads of the medical department at Bengal; and it has been, ever since its publication, a book of the highest authority on all the questions of which it treats, and one of the few composing the libraries of the medical officers in the Indian army.

(*British and Foreign Medical Quarterly Review*, April, 1836.)

TWISS, RICHARD, an English tourist, who died in London at an advanced age, on the 5th of March, 1821. Born to an independent fortune, he indulged his taste for travelling in an extensive tour, which embraced Holland, Belgium (then the Austrian Netherlands), France, Switzerland, Italy, Germany, and Bohemia, and was completed in 1770. Before setting out on his foreign travels he had visited Scotland. In 1772 he undertook a voyage to Spain and Portugal, and in 1775 he went to Ireland. He re-visited France at the time of the Revolution. The subsequent years of his life were devoted to literature and the fine arts, of which, especially of music, he was an admirer. He materially injured his estate by entering into a speculation for making paper from straw. His published works are:—'Travels through Portugal and Spain in 1772 and 1773-4,' London, 1775; 'A Tour in Ireland in 1775-8,' London, 1776; 'The Game of Chess: being a compilation of Anecdotes and Quotations relative to the Game of Chess,' 8vo., London, 1787; 'A Trip to Paris in July and August, 1792,' 8vo., London, 1793; 'Miscellanies,' 8vo., London, 1805. The Travels through Spain and Portugal have been translated into French and German. The tone of the Tour in Ireland provoked great wrath in that country, and elicited 'An heroic Epistle from Donna Teresa Panna y Ruiz, of Murcia, to R. Twiss, with Notes by Himself,' published at Dublin in 1776.

TYCHO BRAHE'. [Brahe, Tycho.]

TYCHONIC SYSTEM. [Brahe, Tycho; System.]

TYCHSEN, OLAUS GERHARD, a celebrated Orientalist, was born at Tondern in Schleswig, on the 14th of December, 1734. His father was a tailor, in very poor circumstances, but with the assistance of some benevolent friends he was enabled to allow his son, who evinced considerable talent, to devote himself to learned studies. Up to his seventeenth year Olaus attended the grammar-school of his native town, and thence went to the gymnasium at Altona, where the celebrated Maternus de Cila had great influence upon him, especially in directing his attention to Oriental studies. In a short time Tychsen made himself master of the Hebrew language, and with the peculiar dialect spoken by the German Jews of all parts of Germany. Thus prepared he went in 1756 to the university of Göttingen. J. H. Callenberg, professor at Halle, was still actively engaged in his labours for the conversion of Jews and Mohammedans to Christianity; and when Tychsen had finished his studies, he thought him a fit person to engage in these undertakings. Tychsen was accordingly sent by Callenberg, in 1759, on a journey through Germany and Denmark. In 1760 Callenberg died, and Tychsen returned without having converted a single Jew. In this year the university of Rostock was transferred to Bützow, and Tychsen was invited as professor extraordinary of Oriental literature; and three years later he obtained the ordinary professorship in the same department. Here he began his varied literary activity, which soon spread his name over all Europe. A part of the professors had remained at Rostock on the transfer of the university to Bützow; and as this would ultimately have led to the establishment of two universities, a re-union of the two parts was brought about at Rostock in 1789, and Tychsen was appointed chief librarian and keeper of the museum of Rostock, which offices he held until his death. In 1810, after having been employed in the university for fifty years, he celebrated his jubilee, and received various honours and distinctions on that occasion. He died at Rostock on the 30th of December, 1815.

Tychsen was a man of extraordinary knowledge in his departments, and, with all his singularities and conceits, he promoted the study of Biblical and Eastern literature more than any man of his time. He undertook the laborious task of collecting the various readings of the Old Testament, of comparing the earliest translations with the original, and of making accurate descriptions of the most remarkable editions of the Bible. His controversies with Benjamin Kennicot were among the first writings of the kind which established sound principles of biblical criticism, although his Pietistical tendency prevented the unbiassed development of his inquiries in theological matters. He wrote several dissertations on the Arabic and Phoenician languages, and on the inscriptions of Persepolis. He also made investigations into the history of the various Christian sects in Asia: and was the first who directed attention to the curious catechism of the Druses in Syria. All these things combined to procure him a European reputation, and engaged him in an extensive correspondence, but they also produced an immoderate degree of vanity, and the presumption of knowing everything, which led him into many gross absurdities, and for which he was now and then severely chastised, as in his controversies with Francis Perez Bayer, archdeacon of Valencia. The most important among Tychsen's works is a journal called 'Bützowsche Nebenstunden' (leisure hours of Bützow), which contains many of his essays. It appeared at Bützow from 1766 till 1769, and consists of six volumes. His library, which was very rich in MSS. and works on Oriental and Spanish literature, together with his collection of curiosities of all kinds, was purchased by the university of Rostock. It was owing to the fame of Tychsen that the Shah of Oude, Ghazi uddin Hyder Redaet ud Dowlah, sent to the university of Rostock a copy of his splendid dictionary and grammar of the Persian language, in seven volumes folio. For a detailed acount of the life and writings of Tychsen, see Hartmann, *Oluf Gerhard Tychsen, oder Wanderungen durch die mannichfaltigsten Gebiete der biblisch-Asiatischen Literatur*. Bremen, 1818-20, 2 vols. 8vo.

TYCHSEN, THOMAS CHRISTIAN, a celebrated Oriental and classical scholar, was born on the 8th of May, 1758, at Horsbyll in Schleswig, where his father, who gave him a sound and careful education, was a clergyman. His first studies in theology and philology were at Kiel: he continued them from the year 1779 at Göttingen under Heyne. After the completion of his academical course he was sent, together with Moldenhauer, on a scientific journey, in which he travelled through Germany, Italy, France, and Spain. On his return in 1784 he was appointed professor extraordinary of theology at Göttingen, and four years later, ordinary professor in the philosophical faculty. He continued here with unwearied activity until his death on the 23rd of October, 1834. During the long period of his professorship various honours and distinctions were conferred upon him, and he was made a foreign member of the Asiatic societies of London and Paris, and of the Danish and Göttingen Academies of Sciences. Of the latter he was elected president in 1797. Tychsen wrote a great number of valuable papers on antiquarian and numismatic subjects, in various scientific periodicals. Among his greater works we may mention his manual of the history of the Jews ('Grundriss einer Geschichte der Hebräer'), Göttingen, 1789, 8vo.; his edition of Q. Smyrnaeus [Quintus Calaber], and his Arabic Grammar ('Grammatik der Arabischen Schriftsprache'), Göttingen, 1823, 8vo.

TYE, CHRISTOPHER, doctor in music—a man who appears prominently in musical biography, both on account of his professional ability, and as possessor of some literary talent,—was, according to Fuller (*Worthies of England*), born in Westminster, and educated in the King's Chapel. He was especially favored by Henry VIII., and held the distinguishing appointment of musical instructor to Prince Edward, and, most probably, the other children of that monarch. He was admitted to the degree of Doctor in Music, at Cambridge, in 1545, and, *ad eundem*, at Oxford three years after. In the reign of Queen Elizabeth he held the office of organist to the Chapel-Royal, for which, Fuller tells us, he produced several 'excellent *Services* and *Anthems*, of *four* and *five* parts, which were used many years after his death;' and, we will add, some few of his compositions are still listened to with unfeigned pleasure, by all true lovers of the art who have acquired any knowledge of its principles and are acquainted with its best specimens.

In a play by Rowley, printed in 1613, is a dialogue between Prince Edward, afterwards Edward VI., and Dr.

Tye, in which the illustrious pupil thus announces his royal father's opinion of the doctor's merit:—

> 'I oft have heard my father merily speake
> In your high praise; and thus his highnesse saith,
> "England one God, one truth, one doctor hath
> For musicke's art, and that is Doctor Tye."'

In later days, 'One God, one Farinelli!' was said of an Italian eunuch, the fanatical lady who screamed it out from a box at the opera not, most likely, knowing that a similar absurdity, not to call it profaneness, had been uttered three centuries before.

Dr. Tye possessed a considerable knowledge of Italian as well as English literature. He translated in verse the affecting story of *Theodore and Honoria* from Boccaccio, and published it in 12mo., black-letter, under the title of 'A Notable Historye of Nastigio and Trauersari, translated out of Italian into English verse, by C. T.—Imprinted at London, in Poule's Churchyarde, by Thomas Purefoote, dwelling at the sign of the Lucrece, anno 1569.' He also commenced a translation of the ACTS OF THE APOSTLES in verse, of which he only completed the first fourteen chapters, and these were printed in 1553, by William Seres. The work was begun because, says Warton (*Hist. of Poetry*), Tye 'had been taught to believe that rhyme and edification were closely connected, and that every part of scripture would be more instructive, and better received, if reduced into verse.' Combining the musician and poet, he set 'notes to eche chapter to synge, and also to play upon the lute,' and dedicated his labours "To the vertuous and godlye learned prince, Edward the Sixth,' his crowned pupil, who certainly took a pride in, and was fond of displaying, the musical skill he had acquired under so scientific and zealous a master. Sir John Hawkins has given a specimen both of the poetry and music of this work in vol. iii. of his History.

Dr. Tye was a constant attendant at court, where his accomplishments rendered him a welcome visitor. In his later days, Anthony Wood says that he became rather peevish, in proof whereof he states that 'Sometimes playing on the organ in the chapel of Queen Elizabeth [that] which contained much music, but little to delight the ear, she would send the verger to tell him that he played out of tune; whereupon he sent word that her ears were out of tune.' This curious anecdote appears, as a note, in the handwriting of Wood, in the *Ashmolean MSS.*, fol. 189.

TYLO'PHORA, a genus of plants of the natural family of Asclepiadeæ, so named by Mr. Brown, from (*tylos*, τύλος, a callosity, and φορ, the root 'to bear'), in reference to the ventricose pollen masses. The genus is distinguished by having a rotate 5-parted corol. Stamineous corona 5-leaved; leaflets depressed, fleshy, toothless inside. Pollen masses erect, fixed by the base, transverse and ascending. Follicles smooth, tapering towards the apex, compressed. The seeds are comose. The species form twining herbs or under-shrubs. The leaves are membranous, flat. The umbels of small flowers interpetiolar or disposed alternately along a common pedicle. They are found in India, the Malayan Peninsula, Java, and New South Wales, and are not of any known use, with the exception of T. asthmatica, which is very common in the peninsula of India, and called in Telinga *kaka-palla*. Dr. Roxburgh describes it as being frequently employed there as a substitute for ipecacuanha. He says that he had often prescribed it himself and always found it answer as well as ipecacuanha, and he had had a similar report from others. Dr. Anderson, physician-general at Madras, had many years before employed it with great success, in a dysentery which happened to be epidemic in the camp. The store of ipecacuanha had, it seems, been wholly expended, and Dr. A., finding the practice of the native doctors more successful than his own, followed their example with good success. He collected and sent to Madras a quantity of the plant which they pointed out to him, as it seemed an article of the Hindu Materia Medica highly deserving attention.

TYLOS. [ISOPODA, vol. xiii., p. 55.]

TY'MPANUM. [EAR.]

TYNDALE, or TINDALE, WILLIAM, whose name is one of the greatest in the history of the English reformation, was, according to the commonly received account, born about 1477, at Hunt's Court, in the parish of Nibley, in Gloucestershire, the residence of his father, John Tyndale, son of Hugh, Baron de Tyndale, of Langley Castle, Northumberland, who, having escaped some years before from a battle in which his party (that of the Yorkists) was defeated, had settled in the county of Gloucester, assumed the name of Hytchins, Hitchins, or Hutchins, and married Alicia, daughter and sole heiress of Hunt, of Hunt's Court. William is said to have been the second of three sons. Of all this however, old Foxe, the Martyrologist, Tyndale's earliest biographer, says nothing; and the story appears to rest for the most part upon tradition, and to have been put together in its present shape in very recent times. Neither the place nor time of the battle from which Tyndale's grandfather made his escape is specified; nor do the retailers of the story seem to think it necessary to account for the circumstance of a Yorkist nobleman being obliged to keep himself concealed (as this account supposes), or at least to remain divested of his titles and his property, throughout the reign of Edward IV. Moreover, the barony of Tyndale of Langley appears to have been extinct for nearly three hundred years before the birth of the reformer: the last baron of whom anything is known died without male issue in the reign of Richard I. John Foxe says, that Tyndale 'was born about the borders of Wales, and brought up from a child in the University of Oxford, where he by long continuance grew up and increased, as well in the knowledge of tongues and other liberal arts as specially in the knowledge of the Scriptures, whereunto his mind was singularly addicted; insomuch that he, lying then in Magdalen Hall, read privily to certain students and fellows of Magdalen College some parcel of divinity.' An antient picture of Tyndale, which has been several times engraved, is preserved in the library of Magdalen Hall. Tyndale however at last removed from Oxford to Cambridge; 'where,' proceeds Foxe, 'after he had likewise made his abode a certain space, being now further ripened in the knowledge of God's word, leaving that university also, he resorted to one Maister Welch, a knight of Gloucestershire, and was there schoolmaister to his children, and in good favour with his maister.' At the house of this Sir John Welch, of Little Sodbury, as he is called by other authorities, Tyndale held many disputes on religious subjects with the clerical dignitaries of the neighbourhood, who frequented Sir John's well-laden table; and this after a time brought him into so much danger, that he deemed it prudent to leave the country and come up to London. After preaching for some time, as he had also been accustomed to do in the country, in the church of St. Dunstan's in the West, he attempted to get into the service of Tonstall, then bishop of London, of whose learning he had conceived a great admiration, and to whom he made his court, by presenting him, through Sir Henry Guildford, master of the horse and comptroller of the king's household, with a translation of one of the orations of Isocrates; but Tonstall replied that his house was full, that he had more people than he could well provide for, and advised him to seek about in London, where he could not long lack employment. After this he was taken into the house of Humfrey Mummuth, or Monmouth, an eminent merchant and one of the aldermen of the city, who kept him for half a year, and then settled upon him an annuity of ten pounds to enable him to live abroad. Monmouth, who was extensively connected with the friends of the new opinions, and who a few years after this got into trouble on that account, said in his own examination before Bishop Stokesley, as reported in another part of Foxe's work, 'The said Tyndale lived like a good priest, studying both night and day. He would eat but sodden meat, by his good will, nor drink but small single beer. He was never seen in that house to wear linen about him, all the space of his being there.' Tyndale now left England, and proceeded in the first instance to Saxony, where he is stated to have conferred with Luther; after which he repaired to the Low Countries and settled at Antwerp, where his services as a preacher were very acceptable to many of the members of the English mercantile factory there established. It was probably while resident here that, if he did not begin, he at least executed the greater part of his English translation of the New Testament. Of this remarkable work the first edition appears to have been an 8vo. volume containing only the text, which was printed at Wittenberg, and published either in 1525 or 1526; the second a 4to., containing glosses as well as the text, the printing of which was begun at Cologne and finished at Wittenberg or at Worms, and which was certainly published in 1526. But this account is in part conjectural, and the subject is one upon which bibliographers are not agreed. [Bible.] These original impressions appear to have been rapidly sold; and both in England, and among the English resident on the Continent, the demand was so great, that the Dutch booksellers found it for their interest to produce a succession of reprints in the course of the next few years. It was not till 1534 that Tyndale himself brought out a new edition, in which the translation was altered and improved in a great many passages. In the interim he had also printed at Hamburg, in 1530, a translation of the Five Books of Moses from the Hebrew, in which he is understood to have been assisted by Miles Coverdale, who afterwards produced the first English translation that was printed of the entire Scriptures; and, in 1531, he published at the same place a version of the Book of Jonas. During his residence abroad Tyndale likewise sent to the press several tracts in vindication of his theological opinions, which were all written in his own native language, and were probably mostly sold in England. He was master of an admirable English style—easy, correct, and lucid, and at the same time full of idiomatic vigour and expressiveness: his translation of the New Testament, in particular, deserves to be ranked as one of the classic works of our literature, one of the finest samples we possess of the language in what may be described as the first stage of its maturity, when it had attained in all essential respects the form and character which it has ever since preserved, although it had not effloresced into the luxuriance and full manifestation of its resources which it exhibits both in the poetry and the prose of what has been called the Elizabethan age. Tyndale finished his career at Antwerp in 1536. His translations of the Scriptures and his other publications had been repeatedly denounced by public authority in England; and at last, in 1534, his person was seized, by the contrivance, it is supposed, of the English government, and he was conveyed to the Castle of Vilvoord, or Villefort, near Brussels, where he was kept in confinement for a year and a half, and, being then brought to trial, was condemned as guilty of heresy in conformity with the imperial decree promulgated at the diet of Augsburg, in 1530. Upon this sentence he was, says Foxe, 'brought forth to the place of execution, was there tied to the stake, and then strangled first by the hangman, and afterward with fire consumed.' The accounts of the affair that have come down to us however are very imperfect and obscure; even the exact dates are wanting.

A new edition of Tyndale's translation of the New Testament was published at London, in small 4to., in 1836; it is very beautifully executed, and professes to be printed verbatim from a copy, supposed to be the only perfect copy extant, in the library of the Baptist College at Bristol, of the first impression of 1525 or 1526. Only some specimens are given of the alterations in the revised edition of 1534. But a reprint of this latter edition has since been produced by the same publisher (Mr. Bagster) in his 'English Hexapla,' Lond., 4to., 1841. All Tyndale's original writings were published, along with those of Frith and Barnes, at London, in 1573, in a folio volume, in which they occupy 478 pp., besides an index; and there is a modern edition of them, along with those of Frith, under the title of 'The Works of the English Reformers William Tyndale and John Frith,' edited by Thomas Russell, A.M., 3 vols. 8vo., London, 1831. In this edition Tyndale's works fill the two first volumes and 70 pages of the third. The most detailed life of Tyndal is a Memoir (of 89 pp.), by Mr. George Offor, prefixed to the late reprint of his New Testament; but it is a very uncritical performance.

TYNEMOUTH, a parliamentary borough, created by the Reform Act, and comprehending the townships of Tynemouth, North Shields, Chirton, Preston, and Cullercoats, in the extensive parish of Tynemouth, in Castle Ward, in the county of Northumberland. The castle, which occupies a peninsula at the northern side of the mouth of the Tyne, and the village of Tynemouth, are about 9 miles east of Newcastle-upon-Tyne: the town of North Shields is a mile or two nearer Newcastle.

It has been supposed that the Romans had a post on the site of Tynemouth castle, and Camden thought it was the Tunnocelum of the 'Notitia,' which others place at Bowness in Cumberland. On the same site a religious house was erected by Oswald, or his nephew Ecgfrid, kings of Northumbria, which was repeatedly plundered by the Danes, and remained desolate until the time of Edward the Confessor, when Tostig, earl of Northumberland, son of Godwin, restored it. It was subsequently made subject to the monastery of Jarrow, afterwards to the monastery of Durham, and at a later period still to St. Albans Abbey, from whence a number of Benedictine monks were transferred to it. In the time of William the Conqueror, the peninsula on which it stood was inclosed on the land side by a wall and a ditch; the place was afterwards more completely fortified, the walls being carried round the site, towards the sea, where there are cliffs which rise to the height of nearly 60 feet, as well as towards the land, and was known as Tynemouth Castle. At the Reformation, when the monastery was suppressed, its yearly revenue amounted to 511*l.* 4*s.* 1½*d.* gross, or 397*l.* 10*s.* 5½*d.* clear. The castle was garrisoned in the time of Elizabeth, and in the great civil war was taken (A.D. 1644), by the Scotch from the Royalists, who had occupied it. Having been restored by the parliament, it was garrisoned by them, but the garrison having revolted, the place was stormed by a parliamentary force from Newcastle, under Sir Arthur Hazelrig. Considerable remains still exist both of the priory and the castle. The gateway tower of the castle on the west or land side is in tolerably good condition, and the circuit of the walls appears to be entire. There are considerable remains of the priory church, built of reddish stone, of various dates and styles, especially Norman and early English. This was used as the parish church until the time of Charles II., when a new church was built at North Shields, distant a mile to the west. There are a lighthouse and some other modern buildings in the castle; and near it are a fort to command the entrance of the river, and a group of buildings, built for barracks, now forming a square of dwelling-houses. The village of Tynemouth is adjacent to the castle, and consists chiefly of one long street. There are some elegant baths, and the place is resorted to by a number of persons in the bathing season.

North Shields rose about the time of Edward I., under the protection of the Prior of Tynemouth, who erected houses here, formed a harbour, and established a market, but the burgesses of Newcastle, regarding the formation of the town as a violation of their charter, obtained a decree which compelled the prior to suppress the market, and destroy the buildings he had erected. The place consequently continued in obscurity until Cromwell, in the time of the Commonweath, caused an act to be passed for forming quays and establishing a market. It was not however till the close of the seventeenth century that the restrictions upon the trade of the place were removed; and from that time the town dates its prosperity. It extends about a mile along the north bank of the Tyne, opposite South Shields, and occupies nearly the whole township of North Shields, and portions of Chirton and Tynemouth. The old part consists of narrow streets and alleys; the newer part has spacious streets and squares, in which are a number of good houses. The town is lighted with gas; Chirton and Preston villages lie back from the river, but Chirton will probably be united in the course of time by the extension of buildings to North Shields. The parish church of Tynemouth is at the eastern end of North Shields, and there are a chapel-of-ease and a new church, the latter completed in 1836; there are also several meeting-houses for Presbyterians, Independents, Baptists, Quakers, and different classes of Methodists; a handsome building for the subscription library, a Scientific and Mechanics' Institute, and a theatre.

The population of the townships included in the borough was in 1831 as follows:—

	Houses.			Population.	
Township.	Inhab.	Uninhab.	Buildg.	Families.	Persons.
Tynemouth .	1724	261	18	2619	10,182
North Shields.	818	12	..	1895	6,744
Chirton . .	636	8	1	1034	4,973
Preston . .	145	2	..	160	765
Cullercoat. .	89	1	..	145	542
	3412	284	19	5853	23,206
Rest of Parish	324	24	..	354	1,572
	3736	308	19	6207	24,778

North Shields is a place of great trade. There are numerous collieries in the neighbourhood, employing, in the whole parish, 1000 men; ships of 300 tons can load at the quays. There is a great export of coals, chiefly to London and the eastern coasts of England and Scotland. Several vessels are engaged in the Greenland and Davis's Straits whale fishery. Ship-building, and the manufacture of sail-cloth, cordage, chain-cables and anchors, are actively carried on: there are salt-pans. There is a market on Friday.

Tynemouth is a vicarage, in the rural deanery of Newcastle, in the archdeaconry of Northumberland and diocese of Durham, of the clear yearly value of 298*l*.

There were in the borough in 1833, an infant-school, 65 other day-schools of all kinds, of which three were also Sunday-schools, and ten Sunday-schools. The infant-school had 32 boys and 33 girls; the other day-schools 1159 boys and 1038 girls, and from 300 to 400 children of sex not stated; and the Sunday-schools (not reckoning the three which were also day-schools), 591 boys, 482 girls, and 80 children of sex not stated. One of the day-schools has a tolerably good endowment.

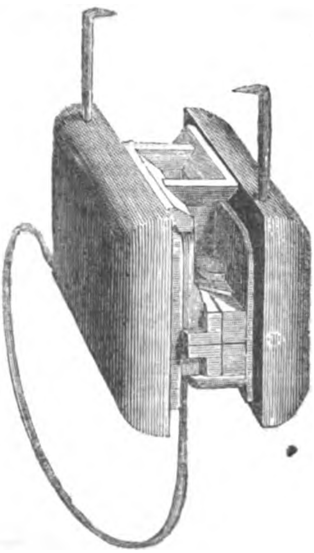
(Hutchinson's *Northumberland;* Wallis's *Northumberland;* Grose's *Antiquities; Parliamentary Papers.*)

TYPE-FOUNDING. In the article Printing (vol. xix., pp. 16, 17) a general view is given of the various steps in the invention of typography, or the art of printing from moveable types, and a brief notice of the individuals whose ingenuity contributed, more or less, to the perfection of the process of type-founding, or the formation of single alphabetic characters which may be arranged so as to form words, sentences, and whole pages capable of being printed from like a single block, and may subsequently be separated and re-arranged at pleasure. To the particulars there given it may be well to add the account of the invention given by the German chronicler Trithemius, which is there only referred to. Translations of this narrative are published in several works on the history of printing, with slight verbal variations; but the version here quoted is that given by Singer. Writing of the year 1450, Trithemius states, that about that time the 'wonderful and then unheard-of art of printing and characterizing books' was invented and devised by Gutenberg, who, after expending nearly the whole of his property in the invention, and experiencing many difficulties, was about to abandon it; when, by the advice and assistance of John Faust, or Fust, he at length succeeded in bringing it to perfection. 'At first they formed (*i.e.* engraved) the characters or letters in written order on blocks of wood, and in this manner they printed the vocabulary called a *Catholicon*. But with these forms (or blocks) they could print nothing else, because the characters could not be transposed in these tablets, but were engraved thereon, as we have said. To this invention succeeded a more subtle one, for they found out the means of cutting the forms of all the letters of the alphabet, which they called matrices, from which again they cast characters of copper or tin of sufficient hardness to resist the necessary pressure, which they had before engraved by hand. And truly, as I learned thirty years since from Peter Opilio (Schoeffer) de Gernsheim, citizen of Mentz, who was the son-in-law of the first inventor of this art, great difficulties were experienced after the first invention of this art of printing; for in printing the Bible, before they had completed the third *quaternion* (or gathering of four sheets) 4000 florins were expended. This Peter Schoeffer, whom we have above mentioned, first servant and afterwards son-in-law to the first inventor, John Faust, as we have said, an ingenious and sagacious man, discovered the more easy method of casting the types, and thus the art was reduced to the complete state in which it now is. These three kept this method of printing secret for some time, until it was divulged by some of their workmen, without whose aid this art could not have been exercised: it was first developed at Strasbourg, and soon became known to other nations.' Another very early account, attributed to a relation of Fust, and quoted in Bowyer's 'Origin of Printing,' and several other works, states that 'Peter Schoeffer of Gernsheim, perceiving his master Fust's design, and being himself ardently desirous to improve the art, found out (by the good providence of God) the method of cutting (*incidendi*) the characters in a matrix, that the letters might each be singly cast, instead of being cut. He privately cut matrices for the whole alphabet; and when he showed his master the letters cast from these matrices, Fust was so pleased with the contrivance, that he promised Peter to give him his only daughter Christina in marriage; a promise which he soon afterwards performed. But there were as many difficulties at first with these letters, as there had been before with wooden ones, the metal being too soft to support the force of the impression; but this defect was soon remedied by mixing the metal with a substance which sufficiently hardened it.'

Without attempting farther to follow the early history of type-founding, it may suffice to state that the apparatus employed appears, at a very early period, to have assumed its present form. The first satisfactory evidence upon this point is afforded by the device of Badius Ascensius, an eminent printer of Paris and Lyons, at the beginning of the sixteenth century; which device was subsequently adopted, with various modifications, by several other printers, among whom was an English practitioner, Anthony Scoloker, of Ipswich. It exhibits the various operations then usually carried on at a printing-office, embracing type-founding as well as composing and printing; and it represents the matrix and other apparatus of the type-founder in the form still used. Most of the early printers, in England as well as the Continent, cut and cast their own types; and one of the earliest notices of that division of labour which has tended so greatly to the improvement of the art, is found in a decree of the Star Chamber, dated July 11, 1637, intended to suppress or render more difficult the publication of seditious works by the Puritans and others opposed to the government, who, about that period, established secret printing-offices for the purpose. This decree ordained that there should be only four founders of letters for printing in the kingdom; and that any vacancies which might occur in that number should be filled up by the archbishop of Canterbury or the bishop of London, and six other high commissioners; and it laid the most stringent regulations upon the master-founders respecting the employment of journeymen and the taking of apprentices. These oppressive restrictions were re-enacted for two years, by an act of parliament of the fourteenth year of Charles II., and renewed for limited periods in his sixteenth and seventeenth years. They were again revived for seven years in the first year of James II., 1685, and finally expired, on the termination of the last-mentioned term, in 1693.

Although Caxton and Wynkyn de Worde had, in the infancy of English printing, established a high character as type-founders, this branch of the art long remained in a depressed state in England, the best types being supplied by continental founders; a circumstance which may, perhaps, be attributed in some degree to the restrictions imposed upon the British founders after their art was separated from that of printing. At the commencement of the eighteenth century native talent was at so low an ebb, that all the types used by London printers for superior works were imported from Holland. William Caslon, who was originally employed in engraving on gun-barrels, and in cutting ornaments and letters for the use of bookbinders, has the honour of removing this stigma upon English ingenuity, and of establishing a well-deserved and permanent pre-eminence for British types. Having executed some remarkably neat letters for lettering books, he was encouraged to attempt punch-cutting; his first engagement in this way being for the Society for promoting Christian Knowledge, for whom he executed an Arabic fount about the year 1720. Caslon was encouraged and assisted by Bowyer; and he soon attained a reputation which not only put an end to the importation of Dutch types, but occasioned a demand for his own on the Continent. His foundry was continued by his descendants, and is still in operation. Another name memorable in the history of English type-founding is that of John Baskerville, of Birmingham, who died in 1775. His stock of beautiful types was sold to a literary society in Paris, and used for printing a splendid edition of the works of Voltaire; his widow having failed to obtain either a purchaser in England, or sufficient encouragement to induce her to continue his business. In Glasgow, where the art of type-founding has been carried to a high state of perfection, it was commenced, in 1718, by James Duncan, whose letters were but rudely cut; but about 1740 it received great improvements from Messrs. Alexander Wilson and John Bain, whose establishment, which is still carried on by the descendants of Wilson, became the most celebrated in Europe. The history of the early British founders is minutely given in a very rare pamphlet, published in 1788, by the eccentric Edward Rowe Mores, entitled 'A Dissertation upon English Typographical Founders and Founderies;' and Hansard, in his 'Typographia,' has reprinted most of the information collected by Rowe Mores, together with notices of more recent type-founders. In France the names of Breitkopf and Didot have attained high celebrity for improvements in type-founding. The printing establishment and foundry of the former, who died in 1794, are said to have acquired the reputation of being the most perfect in the world, not excepting those of the Society de Propaganda at Rome, and to have contained punches for four hundred alphabets.

The first and most important operation of a type-foundry is the formation of the punches, which are well-tempered pieces of steel, each of which bears on its face a single letter, formed with the greatest possible accuracy by filing, cutting, and punching the hollows with smaller punches. The face of the punch exactly resembles that of the finished type: the letter being reversed, and in high relief. The punch-cutter, in addition to the care and judgment required for making the letter of precisely the right size, form, and thickness, so that it may range well with other letters of the same *fount* or set, must consider the best degree of slope for the sides of the letter, so that, on the one hand, he may avoid making them so vertical that the lines will be weak, and easily broken or battered; and, on the other, that they may not, owing to too rapid an increase of thickness towards the base, produce a thick blurred impression when printed from. When the punch is completed and hardened, it is struck into a piece of copper, which, when it has received the impression from the end of the punch, is called a *matrix*, and forms a mould for the face of the type. The striking of the matrix, like every other operation in the formation of the mould, requires great nicety, because, if the punch be not held perfectly vertical, the face of the type will not be at right angles with its sides, and the impression will consequently be uneven. The depth of the impression is also of consequence, as it affects the height of the type; but this may be regulated by filing the face of the matrix. The sides and end of the matrix are then accurately squared; perfect truth in this respect being necessary, in order that, when the matrix is adjusted in the mould, the letter may be perfectly square with that portion of it which is to form the shank or *body* of the type, and may also have its proper position with reference to the top and bottom of the body; so that when the types are set up together and printed from, the letters may not only be upright, but may also range in a perfectly straight line. The *mould*, of which a representation is annexed, consists of two halves, each of which is made of steel, and attached, for convenience of holding, to a piece of wood. The two halves of the mould are so formed, with projecting blocks and recesses to receive them, that they may be instantaneously fitted together, as shown in the cut, leaving a square funnel-shaped opening at the top, by which the type-metal is poured in, and below it the actual mould for the body of the type, with the matrix at the bottom to form the letter or face of the type. The two halves of the mould are so constructed that they will slide a little upon each other, laterally, so as to vary the thickness of the body of the letter, that the same mould may be used, with different matrices, for casting every letter of a fount, from i or l, which have very narrow bodies, to m or w, which have wide bodies. The type-metal is usually melted in a small cast-iron pot, set in brickwork with an enclosed fire under it, and is poured into the mould by a very small ladle. The caster then jerks the mould quickly upwards by a peculiar motion of his arm, and thereby expels the air, and forces the fluid metal to enter the cavities of the matrix. An improvement adopted by some founders consists in having the metal-pot enclosed, with a small force-pump fixed in the cover, by means of which a jet of metal is forcibly injected into the mould, whereby the necessity for the upward jerking motion is obviated. When the metal is set, the caster removes the pressure of the long curved spring at the bottom of the mould, and thereby relieves the matrix from the face of the type. The mould is then separated, and the type is removed by the application of one of the hooks attached to the upper part of each half. Complicated as these operations appear in description, the closing of the mould, casting the type, releasing the spring, opening the mould, and removing the type, are all performed in about the eighth part of minute; so that an expert workman will cast 500 letters in an hour.



A type-mould.

When the types leave the caster, each of them has a small block of metal attached to its shank, being that which filled the throat or funnel of the mould. These are removed by a boy, who takes up the types by their edges, or rather by the top and bottom of the body, and breaks off the superfluous metal by a motion almost too quick to be followed by the eye. The average number thus treated in an hour is 2000, but some boys can break off about 5000. The next operation is rubbing the flat sides (but not the edges) of the types upon a piece of gritstone, the fingers of the rubber being protected by pieces of tarred leather: this also is commonly done at the rate of 2000 per hour. The types are then set up by boys in long rows or lines, and these are firmly secured in long frames, which hold them together while the dresser scrapes or polishes the flat surfaces which form the top and bottom of the body, and cuts a groove or channel along their lower ends by means of a small iron plane. While they are in the frame the types are also *bearded*, an operation which consists in planing away to a bevel the upper angle of the body at the feet of the letters. After dressing, the types are tied up in such lines as may be convenient, and the proportionate numbers of every type of which a fount consists are selected. All the types belonging to one fount are distinguished by one or more grooves or *nicks* across the lower edge or bottom face of the body, by which simple contrivance the compositor is enabled to see, or even to feel, without looking at the face of the letter, when a type is inverted. These nicks, which should be different in number or position in each fount used in a printing-office, are formed by the insertion of one or more wires in the mould.

Although the composition of type-metal varies greatly in different countries, and even in the practice of different British founders, lead almost invariably forms the principal ingredient. Some of the earliest founders are supposed to have used iron to harden it; but in modern times regulus of antimony is commonly employed for the purpose. Hansard states that in Germany an alloy, consisting of steel, iron, copper, brass, tin, and lead, incorporated with each other by means of antimony, is used for the purpose. It will not bend, but it breaks like glass; and it is said to be harder than tin and lead, softer than copper, and more fusible than lead. The same authority states that the alloy used in Holland is unknown, but that it probably differs from those used in Germany and in England. Moxon, an English writer of the seventeenth century, describes an alloy of 25 parts lead to 3 parts of iron and antimony melted together. For large types a mixture of 85 parts lead and 15 parts antimony forms a good alloy; but small types require to be of harder metal, and often have 25 parts of antimony to 75 of lead. Some founders add a little tin or bismuth; the latter metal being seful from its singular property of enlarging as it cools, hich aids the production of a perfect cast. The exact omposition of the alloys used by many founders is care-ully kept secret.

Some letters, from their peculiar form, require more care han others, owing to the projection of certain prominent oints beyond the shank or body of the type. Such are alled *kerned* letters; and, from their greater liability to ijury, rather more than a due proportion of them is cast ith a fount. In the common Roman alphabet, f and j re the only kerned letters; but in an Italic fount, *d*, *g*, *j*, and *y* are kerned on one side, and *f* on both sides, and ome of the capitals also. As the kerned f cannot be laced close to another f, an i, or an l, it becomes neces-ary to cast what are called *logotypes*, or types containing vo or more letters cast on one body. Those in common se are ff, fl, fi, ffi, and ffl. Earl Stanhope, in his experi-ents on stereotyping, found inconvenience to arise from e plaster of the mould occasionally getting under the rojecting part of the f, which rendered it difficult to emove the mould without fracture; and he therefore pro-osed a slight alteration in the form of that latter, by which e neck should be so constructed as to bring every part ithin the limits of the body of the type; and, as this teration rendered the common logotypes unnecessary, he ad others cast in their stead, such as th, an, &c., which ould be much more frequently required. The Stanhope has however failed to come into general use, probably n account of its ungraceful form; and experience appears have established the superior convenience of composing ith single letters over the use of logotypes or syllabic pes. An attempt was made on a very extensive scale in e last century to introduce the use of types bearing whole ords or syllables, under the name of *logography*, or *logo-raphic printing*, but although an edition of Anderson's History of Commerce,' in four quarto volumes, 1787-9, nd some other works, were printed in this way, the scheme as eventually abandoned.

As the several letters of the alphabet are, in common rinting, required in very different proportions, the number ast of each letter in a fount needs to be carefully regulated. he proportions vary in different languages, and in differ-nt kinds of work; but for ordinary English book-work ey are about as follows:—

a	8,500	n	8,000	ff	400
b	1,600	o	8,000	fi	500
c	3,000	p	1,700	fl	200
d	4,400	q	500	ffi	150
e	12,000	r	6,200	ffl	100
f	2,500	s	8,000	æ	100
g	1,700	t	9,000	œ	60
h	6,400	u	3,400	,	4,500
i	8,000	v	1,200	;	800
j	400	w	2,000	:	600
k	800	x	400	.	2,000
l	4,000	y	2,000	'	700
m	3,000	z	200		

To the above are added accented and dotted letters, in umbers ranging from 100 to 250; numerals 1 to 9, and 0, om 1000 to 1300 each; and notes or marks of reference, arentheses, brackets, &c., in number varying from 60 to 00. The number of CAPITALS supplied with such a unt range from the lowest number, 80 (Z), to the highest, 00 (I), with 40 of Æ and 30 of Œ. Of SMALL CAPITALS, e number required in ordinary cases is about one-half at of large capitals; and *Italics* are also supplied in small umbers. Spaces, which are pieces of metal resembling e shanks or bodies of letters, and used to separate words, re cast of various thicknesses, to enable the compositor to *ustify* his work, or to fill up each line to the same degree f tightness, by varying the spaces between the words. Of e smallest kind, which are called, from their extreme inness, *hair-spaces*, 3000 are supplied with a fount of the bove extent. Of the three next sizes, called *thin*, *middle*, nd *thick spaces*, the numbers are 8000, 12,000, and 18,000 espectively. The next in order are n-*quadrats*, or spaces qual in body to the letter n, of which 5000 are required; nd m-*quadrats*, double in thickness of the last, and similar n body to the letter m, which is exactly square, or as wide s it is deep, of which the number is 2500. In addition to hese are larger quadrats, equal in body to two, three, or our m's, which are used for filling up lines at the end of a paragraph, or in poetry, and for setting up blank lines in order to separate two paragraphs. These are supplied by weight, according to the kind of work for which the fount is required.

Although all British founders employ the same names for types of similar size, it is to be regretted that perfect uniformity in the sizes is not sufficiently attended to to allow the types of different foundries to be used together without inconvenience. The subjoined specimens show the various sizes employed in England for book-work, beginning with the largest, and descending to the most minute:—

1. *Great Primer* is the largest type ever used for printing books. It is seldom employed for anything excepting large folio Bibles, and on this account is sometimes called *Bible Text*. The French call this type *Gros Romain*, and the Germans, from its having been the third of seven sizes formerly used, name it *Tertia*. About 51½ m's in width, or the same number of lines in depth, occupy a foot.

2. *English*, called by the French and Dutch *St. Augustin* (from which it it supposed to have been first used for printing the works of that author), and by the Germans *Mittel*, as the middle of the seven signs above alluded to, is used for printing Bibles and other works in folio and quarto. There are about 64 m's to a foot.

3. *Pica*. This type is much used for printing the text of standard library works, and is generally referred to by printers as a standard for the measurement of work. Leads, brass-rules for printing lines, braces, or quotations, &c., are always made to so many Pica m's, whether used with this type or not. In France and Germany it bears the name of *Cicero*, apparently from having been originally used in printing his Epistles. 71 Pica m's go to a foot.

4. *Small Pica*, called *Philosophie* in France, and *Brevier* in Germany, is a type very extensively used; perhaps more than any other. Novels are almost invariably printed in this letter, of which about 83 m's go to a foot.

5. *Long Primer*. This neat type, which is much used for printing works in duodecimo, is called *Petit Romain* in France, and *Corpus* in Germany; the latter name being probably derived from its use in printing the 'Corpus Juris:' 89 m's of Long Primer go to a foot.

6. *Bourgeois* appears, by its name, to have come originally from France; but the French type which comes nearest to it is now called *Gaillarde*. Hansard states, in the article 'Type-founding,' in the 'Encyclopædia Britannica,' that the Germans have no type corresponding with this. It is a type very much used, and is that employed for the text of the 'Penny Cyclopædia.' It is half the size of Great Primer, and about 102 m's go to a foot.

7. *Brevier*, called in France *Petite Texte*, and in Germany *Petit* or *Jungfer* (maiden letter), derives its English name, most probably, from its having been first used for printing breviaries, or Roman Catholic church-books. It is employed for printing small works, and for notes to those printed in larger type. In this work it is used in the indexes appended at the end of each letter. About 112½ m's go to a foot.

8. *Minion* (French, *Mignonne;* German, *Colonel*) is used principally in newspapers, although some Bibles and prayer-books, and pocket editions of other works, are printed in it. It is half the size of English; and 128 m's go to a foot.

9. *Nonpareil* (French and German, *Nonpareille*). Hansard observes, of this beautiful type, that at its introduction it was, of course, without a peer in comparative size to the larger types; and he thinks that it still retains its character, and that every smaller type is below the compass that any eye of medium sight is able to read without pain. It is employed in the foot-notes occasionally introduced in this work. Its size is half Pica; and 143 m's go to a foot.

10. *Ruby* is a somewhat irregular size introduced by English founders subsequently to the smaller types given below, and is employed for pocket dictionaries, Bibles, prayer-books, &c. Hansard states that it was originally a Nonpareil with short ascenders and descenders, cast on a smaller body; or sometimes a Pearl, cast on a larger body, to give it an open appearance. The body of Ruby is about half that of Long Primer, and about 163 m's go to a foot.

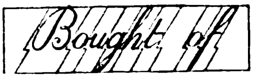
11. *Pearl*, called by the French *Parisienne*, and by the Germans *Perl*, was the size cut next to Nonpareil. It is a beautiful letter for printing miniature editions, and is sufficiently clear to be read with facility by persons of strong sight. It is also much used for notes to books printed in larger type. Pearl is half the size of Long Primer; and about 178 m's go to a foot.

12. *Diamond*, to which the same name is given in France and Germany, is the smallest type used in this country, and is rarely employed excepting for Notes. Books printed wholly in this letter are typographical curiosities, and require the greatest possible care in printing. The stereotyping of Diamond

type was formerly deemed impracticable, but it has of late years been successfully accomplished. The difficulty of making and composing type so exceedingly minute may be conceived from the fact that about 2800 of the letter i go to a pound weight, and about 6000 of the smallest space. Henri Didot, the eminent French type-founder, cut a type smaller than the English Diamond, his fount being half Nonpareil, while Diamond is half Bourgeois; and Hansard states, in his 'Typographia,' that Mr. Bessemer, who cut the Diamond of the Caslon foundry, commenced a smaller fount to rival that of Didot, but we are not aware that it was ever brought into use. From the same authority it appears that the Dutch were the first in Europe to cut Diamond type, and Mr. Fry the first in England.

Of types larger than those employed for book-work, the first, in an ascending series, is called *Paragon;* the next is *Double Pica*, which is twice the size of Small Pica; above which are *Two-line Pica*, *Two-line English*, *Two-line Great Primer*, and *Two-line Double Pica*, each of which is double the size of the common type from which its name is taken. One other type, *Canon*, has also a distinctive name; but all above it are called, according to the number of Pica m's in their height, *Five-line Pica*, *Six-line Pica*, &c. Large letters, such as are used in posting-bills, were formerly cast in sand-moulds, and hence called *sand-letters;* but the fourth William Caslon introduced a convenient method of making matrices for such types, without the use of punches, by cutting the letter completely through a piece of copper or brass from one-eighth to one-fourth of an inch thick, making the apertures wider on one side than on the other; and then riveting the plate so cut with the face (or side at which the apertures are smallest) downwards upon a smooth surface of brass, which forms the face of the letter.

Ornamental types are made in endless variety for printing cards and circulars, and for other fancy purposes; but of these it is only necessary to mention particularly what is called *Script* type, which is cut to imitate writing. The early attempts to imitate cursive characters by letters cast upon a square body were very clumsy, it being impossible under such circumstances to give an easy inclination to the letters, and to make them join neatly. To remedy this M. Firmin Didot invented types with a body the sides of which form oblique angles with the top and bottom, and are so formed that they will, nevertheless, lock firmly together, without any inclination to slide upon each other. This may be readily understood from the annexed cut,

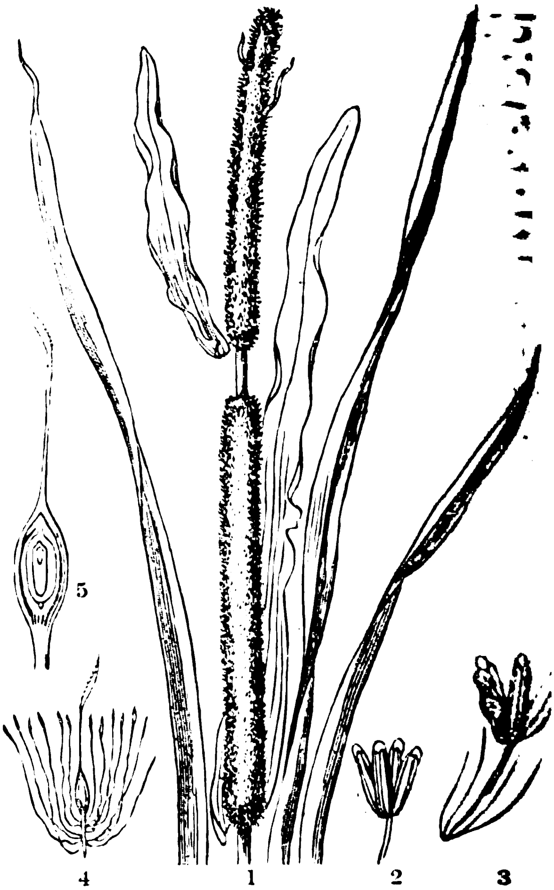


which represents the words 'Bought of' set up in script type, with a triangular piece of metal added at each end to allow of their being wedged up with type or quadrats of the usual form. Didot cast, on bodies of this form, the component parts of lettters; but his idea was improved upon by English founders, who cast the letters complete, and provide for every variety of junction which may be required by casting some of the letters on different bodies, according to the relative positions they may be required to occupy. More recently, some founders have succeeded in casting types on a square body which answer the same purpose as Script, and these, on account of the greater facility of composition, are more generally used for common work.

Many schemes have been suggested for facilitating the manufacture of types by the use of machinery; but as these have failed to come into general use, they may be dismissed with a very brief notice. One of the earliest formed part of a very comprehensive project for the improvement of printing brought forward by Mr. William Nicholson, editor of 'Nicholson's Journal,' about 1790. Another, which was patented about 1823, by Dr. William Church, of Birmingham, proposed to cast types at the rate of 75,000 per hour, and to melt and recast them after each time of printing from. A third, of less pretensions, inasmuch as it does not propose to dispense with the subsequent rubbing and dressing, is the process of Henri Didot, patented in England by Louis John Pouchée, for casting at the rate of 24,000 per hour; which has been successfully practised, although it does not appear likely to supersede the ordinary mode of casting by hand.

TYPHA'CEÆ, a natural order of plants, belonging to Lindley's spadicose group of monocotyledons. The order includes two genera—Typha and Sparganium. They are herbaceous plants, growing in marshes and ditches, having stems without nodi and perennial rhizomata; the leaves are rigid, ensiform, and with parallel veins; the inflorescence is spicate or capitate, without a spathe; the flowers are unisexual; sepals 3 or more, sometimes merely a bundle of hairs; no petals; the male flowers have 3 or 6 stamens, with wedge-shaped anthers and long filaments, which are sometimes united; the female flowers have a single, superior, 1-celled ovary, with a solitary pendulous ovule; the style is short, and surmounted with one or two simple linear stigmas; the fruit is dry, 1-celled, and 1-seeded; the embryo is in the centre of the albumen, with the radicle next the hilum.

Brown makes Typhacea a section of Aroideæ, but most systematic botanists have followed Adanson in making this an independent order. The trisepalous, semiglumaceous calyx, or sometimes a bundle of hairs, with their long filaments, clavate anthers, solitary ovules, and peculiar habit, are very characteristic. The species of the two genera are abundant in the northern parts of the world, and are mostly absent in tropical countries.



Typha angustifolia.

1, spadix crowded with flowers; 2, stamens with united filament; 3, do. larger; 4, ovarium surrounded at the base with setæ; 5, section of ovarium exhibiting solitary pendulous ovule.

The genus *Typha* is known by the male and female flowers being both seated on the same spike, the male flowers being uppermost; the stamens are setose, and united by the filaments; the ovarium is surrounded by setæ (see *Fig.* 4); and the style is persistent. There are three species of this genus, inhabitants of the temperate parts of the globe, and all are found in Great Britain. The name *Typha* is derived from *tiphos* (τῖφος), a marsh, because these plants grow in marshy places. In English they are called cat's-tail and reed-mace, the former from the resemblance of their spikes to the tail of a cat. They are frequently called bull-rushes, but this name is restricted to another genus, the *Scirpus*.

T. latifolia, Great Cat's-tail or Reed-mace, has linear, nearly plane leaves, with the sterile and fertile flowers continuous. This is a very handsome aquatic, and grows abundantly in damp marshy places. The leaves are three feet in length and an inch in width. When the densely crowded spike is brushed and a lighted candle applied near it, a sudden flash is produced. This arises from the firing of the pollen that is diffused in the air. On the Continent the down of the flowers is used for stuffing pillows, &c.; cattle are fond of the leaves, and the roots are sometimes eaten as a salad. In common with

Sparganium and Scirpus, the leaves are used by coopers for filling up the interstices between the wood of their casks; also for making mats, chair-bottoms, baskets, &c. It is this plant which many of the Italian painters have put in the hand of Christ when he was mocked by the Roman soldiers as a king.

T. angustifolia, Lesser Cat's-tail or Reed-mace, has linear leaves grooved below, with the sterile and fertile flowers removed at a little distance from each other. It is less frequent than the last species, but is not uncommon in the neighbourhood of London.

T. minor, Dwarf Cat's-tail or Reed-mace, has linear-setaceous leaves, with barren and fertile flowers at a great distance. This plant, on the authority of Dillenius, has been placed in the list of British plants. It is found in the south of Germany and Switzerland. Kock calls it *T. minima*. For the characters of Sparganium, see that article.

TYPHIS (Malacology), De Montfort's name for a genus of testaceous mollusks: type *Murex tubifer*.

Typhis tubifer, according to M. Deshayes, occurs both living and fossil (tertiary).

Mr. Broderip has described five additional species; two of which were brought to this country by Mr. Hugh Cuming, and one by Captain Belcher, R.N.

Mr. Cuming's specimens were found at Caracas and West Columbia (Salango), in sandy mud at the depth of six and seven fathoms; and Captain Belcher's was taken at Cape Blanco (Western Africa).

Of these, *Typhis Belcheri* approaches nearly to the Grignon fossil, *Typhis frondosus*, J. Sow.

Of the other two species, *T. Sowerbii* and *T. pinnatus*, the first inhabits the Mediterranean Sea: the locality of the other is unknown.

The fossil analogues of this genus have hitherto been found in the London clay, calcaire grossier, and sub-Apennine beds. (*Zool. Proc.;* Müller's *Synopsis*.)

Typhis is also used subsequently by M. Risso to designate a genus of ISOPODA (vol. xiii., p. 56).

Cuvier places this genus among the *Amphipoda*, between *Apseudes* and *Anceus*.

There are only two small antennæ. The head is large, with the eyes not projecting. Each pair of feet is annexed to its proper segment; the four anterior feet are terminated by a didactylous claw. On each side of the thorax are two moveable plates, forming a sort of valves, which, when united, and when the animal folds its feet and its tail underneath, close up the body below, and give it the form of a spheroid. The posterior extremity of the tail is without appendages. (*Règne Animal.*)

TYPHLOPHTHALMES, the name by which MM. Duméril and Bibron designate the last family of SCINCOIDIANS, comprehending those SAURIANS which are completely blind, or whose eyes are so small that they do not exist, so to speak, excepting in the rudimentary state, and entirely covered with skin, through which they are not even to be distinguished, as they still may be in other Saurians, AMPHISBÆNA for instance, above whose eye the skin passes without being divided into two lids, as in the *Saurophthalms*, or pierced circularly so as to leave the globe of the eye entirely naked, as in the *Ophiophthalms*.

MM. Duméril and Bibron observe, that in the present state of science there are only known two species which can be referred to the subfamily of *Typhlophthalm Scincoidians;* these two species have, both the one and the other, the body elongated, narrow, cylindrical, like that of the species of ACONTIAS [JAVELIN SNAKE], or *Typhlops:* nevertheless they differ from each other in many other points of their organization, so as to justify their separation into two genera, distinguishable at first sight, the one being entirely without limbs, and the other having two at the posterior part of the trunk.

Dibamus. (Dum. and Bibr.)

Generic Character.—Muzzle conical, encased up to the forehead in a scaly covering composed of three pieces; lower jaw protected in the same manner. Nostrils lateral, rounded, pierced in the median piece of the rostral case, without a groove behind. Tongue flat, suboval, squamous, not divided at its anterior extremity, notched semicircularly backwards. Teeth conical, simple, equal. Palate entire, not toothed. No auricular apertures. A single pair of limbs (posterior), which are short, flattened, or reniform. Tail short, truncated, rounded at the end. Scales smooth.

MM. Duméril and Bibron state that the *Dibami* have neither groove nor notch on the palate, nor are there any teeth observable there: their tongue, scarcely extensible, is large, thick, of nearly an oval form, not incised in front, but semicircularly notched, as it were, behind; its surface is covered with a very great number of small flattened imbricated papillæ, having the appearance of scales. The teeth which arm the jaws are short, equal, conic, and slightly pointed. The nostrils are two small round holes, pierced on each side of the muzzle in the great plate at its end and above it, and to which are soldered two other plates which cover, one on the right and the other on the left, the upper lip. A single great plate protects the lower jaw. There is no distinguishable trace of the ear externally. There are no anterior feet, but at the sides of the vent are attached two small scaly appendages which represent the posterior limbs. The tail is very short, cylindrical, of the same size as the body, truncated and rounded behind.

Example, *Dibamus Novæ Guineæ*, Dum. and Bibr. (*Acontias Subcæcus* of the Leyden Museum). Olive brown.

Locality, New Guinea.

Typhline. (Wiegmann.)

Generic Character.—Muzzle conic, incased to the forehead in a squamous covering of a single piece; lower jaw protected in the same manner. Nostrils lateral, small, communicating with a longitudinal furrow situated backwards. Teeth conic, simple, equal. Palate not toothed, with a longitudinal groove behind. Tongue in the shape of an arrow-head, squamous, notched at its point. No auricular apertures. No limbs. Tail short, truncated, rounded at the end. (Dum. and Bibr.)

MM. Duméril and Bibron state that *Typhline* is distinguished from *Dibamus* in being apod, and in having the tongue arrow-head-like and incised at its point; in having the palate grooved for the second portion of its length; and, finally, in having the muzzle marked on each side behind the nostril with a longitudinal furrow, with which this last communicates. Type, *Acontias cæca*, Cuv.

Example.—*Typhline Cuvierii*, Wiegm. (*Acontias cæcus*, Merr., Cuv., Gray). Colour a yellowish tint reticulated with violet.

Locality, South Africa.

TYPHLOPS, Schneider's name for a genus of reptiles placed by Cuvier among the *Ophidians*, or SERPENTS, and thus characterised by him:—

Body covered with small imbricated scales, as in the *Orvets* [ORVET], among which naturalists long arranged them; the muzzle advanced, furnished with plates, the tongue rather long and forked, the eye like a point, hardly visible through the skin, the vent nearly entirely at the extremity of the body; one lung four times greater than the other.

These, adds Cuvier, are small serpents similar in point of aspect to earth-worms, and species are found in the warm climates of both continents.

Some have the head of the same size as the body, and obtuse. They resemble ends of fine packthread (bouts de ficelle mince). *Typhlops braminus*, Cuv. (Russel, *Serp. Corom.*, xliii.).

The greater part have the muzzle depressed and obtuse, furnished with many plates in front:—*Anguis reticulatus*, Scheuchzer, *Phys. Sacr.*, pl. 747.

In some the fore part of the muzzle is covered in front with a single large plate whose anterior border is slightly trenchant:—*Anguis lumbricalis*, Lacép., ii., pl. xx.; Browne, *Jam.*, xliv. 1; *Seb.*, i., lxxxvi. 2.

Finally, there is one which has the muzzle terminated by a small conic point, and is entirely blind. Its posterior extremity is enveloped in an oval and horny buckler. *Typhlops philippinus*, Cuv., eight inches (French) in length, and entirely blackish. (*Règne Animal.*)

Cuvier arranges this group immediately after the *Amphisbænæ* [AMPHISBÆNA], and immediately before the *Serpents* properly so called.

Mr. Swainson makes the *Amphisbænidæ*, or *Blind-worms*, the fifth and last family of his *Ophides*, comprise the following—

Genera: *Amphisbæna*, Linn. (with the subgenus *Leptosternon*, Spix); *Typhlops*, Schn. (with the subgenera *Stenostoma*, Spix, *Typhlops*, *Rhinophis*, Wagl., and *Typhlina*, Wagl.); *Anilius*, *Coral Snakes* (with the subgenera *Anilius*, Oken, and *Uropeltis*, Cuv.).

The genus *Typhlops* is thus characterised by Mr. Swainson:—

Eyes hardly visible; anus close to the extremity of the body, which is subcylindrical, and covered with small imbricate scales; front of the head with plates; muzzle produced.

Stenostoma he characterises as having the muzzle depressed, obtuse, and covered in front with several plates. *S. reticulata*, Spix.

Typhlops, as having the muzzle with a single frontal sharp-edged plate. *T. lumbricalis.*

Rhinophis, as having the muzzle pointed, conical; tip of the tail enveloped in a horny shield; eyes hid. *R. philippinus.*

Typhlina, as having the muzzle with a single convex plate; eyes none; tail ending in a spire. *T. septemstriatus.*

The genus *Anilius* is characterised by Mr. Swainson as follows:—

Body and head cylindrical, with small imbricate scales, which are but slightly larger on the belly and under the tail; the latter extremely short. (*Tortrix*, Oppel.)

Mr. Swainson observes that it remains to be determined whether this group enters among the *Coluberidæ*, connecting them with the *Anguidæ*, or forms a portion of the latter family. In placing them among the former, Mr. Swainson says he has adopted the views of Cuvier. To the *Amphisbænæ*, he observes, they seem related by analogy. The subgenera *Anilius* and *Uropeltis* he thus characterises:—

Anilius.—Tail obtuse; a single series of larger scales beneath. *Anilius corallinus*, Seba, ii., pl. 73, figs. 2-3.

Uropeltis.—Head very small, muzzle pointed, tail obliquely truncated, with a double range of scales. *U. Ceylonicus*, Cuv. (*Classification of Reptiles.*)

Mr. J. E. Gray places the *Typhlopsidæ*, consisting of the genus *Typhlops* only, between the *Acontiadæ* and the *Geckotidæ*, in the order *Sauria*.

The *Acontiadæ*, according to his arrangement, comprise the genera *Nessia*, *Enesia*, *Acontias*, *Dibamus*, and *Typhline.* [TYPHLOPHTHALMES.]

TYPHO'NIUM, a genus of plants of the natural family of Aroideæ, including several species of Arum of Linnæus, Roxburgh, and other botanists. The genus is distinguished among the Euaroideæ by having the spathe convolute at its base. Spadix interruptedly androgynous below, with rudiments of the sexual organs below the stamens, naked, with a subulate apex. Ovaries with a single ovule, affixed at the base, erect. The species are all stemless herbs, indigenous to India, but with perennial tuberous root-stocks, leaves with long footstalks, nerved, cordate or hastate entire, with the scape protruding beyond the sheathing bases of the leaves; the spathe of a uniform colour. Of these T. orixense is described by Dr. Roxburgh by the name of Arum orixense, and as common in the shady mango-groves near Samulkota, where the soil is dry and fertile. It is called *Ghekool* by the natives. Like many other of the Aroideæ, this plant is exceedingly acrid; when fresh, more so, Dr. Roxburgh says, than either A. Dracunculus or maculatum; and that the natives apply them as cataplasms to disperse or bring forward tumours. They also apply them externally to the bite of venomous snakes, at the same time giving inwardly about the size of a field-bean. As it is a most powerful stimulant, Dr. R. was of opinion that, in proper hands, it might be used to great advantage in the cure of several disorders.

TYPHOON (Greek τυφῶν, a whirlwind) is a name frequently applied to a tropical storm: it is also given to the hot winds which occasionally blow with great violence in Africa, Syria, Arabia, and Persia; and which are felt, though rarely and with much-diminished force, in the southern parts of Italy and Spain. The sirocco of Egypt and the coasts of the Mediterranean, the simoom of Arabia, and the harmattan of the coast of Guinea, are understood to be so many designations of the typhoon; all of them being supposed to originate in the same cause, with modifications depending merely on the nature of the particles exhaled from the ground in the different countries.

Frequently when the winds have a whirling as well as a progressive motion, columns of sand are raised and driven about with great rapidity; and Burckhardt observes that in Africa and the East the dust obscures the face of the sun, giving to the atmosphere a blue, a yellow, or a reddish tint, according to the colour of the sands over which the wind blows. M. de Humboldt occasionally observed columns of sand in motion in the interior of South America.

The fatal effects which have been said to result both from the masses of moving sand and from the supposed deleterious quality of the winds, are now considered as exaggerations: the inconveniences felt by men and animals during the continuance of the hurricane are chiefly such as arise from the heat and dryness of the air, and from the quantity of sand which is blown into the eyes. [SAMIEL; TORNADO.]

TYPHUS. [FEVER.]

TYRANNI'NÆ. [SHRIKES, vol. xxi., p. 415.]

TYRA'NNIO (Τυραννίων), a Greek grammarian, and a native of Amisus in Pontus, was made prisoner by Lucullus during his campaign in Pontus, B.C. 72. According to Suidas the original name of this grammarian was Theophrastus, instead of which he was nick-named or surnamed Tyrannio on account of his severity towards those who studied under him. He was carried to Rome by Lucullus and given as a present to Murena, who restored him to freedom. At Rome he occupied himself with teaching and study, and is said to have amassed a considerable fortune. He is also said to have been employed in arranging the celebrated library of Apellico, which Sulla had brought from Athens, and which contained most of the works of Aristotle and Theophrastus. (Plut., *Sulla*, 26; Strabo, xiii., p. 609.) That he had a great knowledge of books is clear from the fact that Cicero employed him in arranging his library, which Tyrannio did to the great satisfaction of Cicero. (Cicero, *Ad Att.*, iv., 4 and 8.) That he however should himself have possessed, as Suidas states, a library of upwards of 30,000 volumes, is hardly credible. Cicero speaks with great respect of his knowledge and his mode of instruction; and we know that about the year B.C. 56 he gave lessons in the house of Cicero to Quintus, the son of Cicero's brother Quintus. (Cicero, *Ad Q. Frat.* ii. 4.) Strabo (xii., p. 548) also mentions him as one of the persons whose instruction he had received. He appears to have possessed considerable knowledge of geography, for Cicero attributes much importance to some objections which he made to Eratosthenes (*Ad Att.*, ii. 6). Cicero alludes to a work of Tyrannio which he valued, but does not inform us on what subject it was written (*Ad Att.*, xii. 6; *Ad Q. Frat.*, iii. 4). Tyrannio died of a paralytic stroke at a very advanced age. (Suidas, *s. v.*)

Suidas mentions a second or younger Tyrannio, whom he calls a native of Phœnicia and a pupil of the elder Tyrannio, whose name he also adopted, as his real name was Diocles. He was made prisoner in the war between Antony and Octavianus, and was bought by one Dymas, a freedman of Octavianus. He gave him to Terentia, the wife of Cicero, who restored him to freedom, after which he occupied himself with teaching. He is said to have written sixty-eight works, all of which are now lost. Suidas mentions the titles of some, such as 'On the Prosody of Homer,' 'On the Parts of Speech,' 'On the Latin Language,' 'On Orthography,' and similar other grammatical works. The circumstance that a copious writer like this Tyrannio is not mentioned by any antient author except Suidas, has led some modern critics to suppose that he never existed, and that Suidas has made some great blunder. (Brucker, *Hist. Philos.*, ii., p. 19.)

A third Tyrannio is mentioned by Suidas as the author of a work on Auguries, in three books, and some other works which are not specified.

TYRA'NNULA. [SHRIKES, vol. xxi., p. 415.]

TYRANNUS. [SHRIKES, vol. xxi., p. 415.]

TYRANNY. [TYRANT.]

TYRANT. The words tyrant and tyranny come respectively from the Greek *tyrannos*, *tyrannis* (τύραννος, τυραννίς), through the Latin. The earliest instance of the word tyrannus is perhaps in the Homeric hymn to Ares (Mars). It is used by the earliest extant Greek historians, Herodotus and Thucydides, to signify a person who possessed sovereign power and owed it to usurpation, or who derived it from a person who had obtained such power by usurpation, and who maintained it by force. A familiar example of a tyrant is Pisistratus, who usurped the supreme power at Athens B.C. 560, and was succeeded in it by his eldest son Hippias. A Greek tyrant who obtained sovereign power was a monarch in the proper sense of that term. [MONARCH.] If he acquired a power which was somewhat less than sovereign, he was not monarch; but in either case he would perhaps be called tyrannus; and accordingly the word does not express with accuracy the degree of political power which an individual acquired, but it rather expresses the mode of acquisition, or refers to its originally illegal origin. Still the term tyrant, as used among the Greeks, always indicates that the person so called was at the head of the state, and possessed at least more power than any other individual or any number of individuals in it. The word, as used by the older Greek writers, did not carry with it any notion of blame: it simply denoted a person possessed of such political power as above mentioned, whether he used it well or ill. Many so-called tyrants were popular with the mass of the community, and were men of letters, and patrons of literature and art. They might appropriately be called kings or princes in the modern acceptation of those terms, except perhaps that the uncertainty of their tenure of power and the want of a recognised hereditary succession in the tyranny, or a regular mode of succeeding to it, would render the application of any modern name inappropriate.

In some passages in Herodotus (iii. 80, &c.; vi. 23, &c.; vii. 165) the words monarch and tyrant are used as synonymes to express an individual who possesses sovereign power; and in one instance at least (vi. 23, 24) he calls the same person king (βασιλεύς) and monarch (μούναρχος). Aristotle (*Polit.*, iii. 7), after stating that a polity or government must either be in the hands of one or of a few, or of the many, adds that we are accustomed to call a monarchy which has regard to the interests of all members of the state a kingship (βασιλεία); and that a monarchy which has regard only to the interests of the monarch is a tyranny. In the case of Miltiades, who became tyrant of the Thracian Chersonesus, Nepos (*Miltiad.*) remarks that 'all persons are considered and called tyranni who enjoy lasting power in a state which has once been free.' This definition seems to express pretty clearly the old Greek notion of a tyrant, but it leaves out of consideration the mode in which the power was acquired. Nepos remarks that Miltiades was called 'Tyrannus sed justus,' 'tyrant, but tyrant in constitutional form' (not *just*), for he had been elected by the people. Accordingly, he says in another place, he had the dignity or rank of king without the name. This is consistent with Herodotus (vi. 36), who says that the people made Miltiades tyrant (τύραννον κατεστήσαντο).

Few of the Greek tyrannies lasted long, and the conduct of those who held this power was generally such as to attach in the course of time an odious signification to the word tyrant; but it does not exactly appear when this change in the signification of the word was introduced. Tyrannies among the Greeks seem to have arisen about the time of Archilochus, when the old kingly forms of government had been generally abolished, and democratic and oligarchic constitutions had been established in their place. But as such constitutions laboured under the defect of being badly organized, there was often a contest of parties in a state, which may be represented by the terms democratic and oligarchic parties; and an aspiring citizen had thus the opportunity of acquiring the sovereignty by joining one or the other, and thus making himself a tyrant in the Greek sense of the term. Many of the old Greek tyrannies were abolished in part by the influence of Sparta, the constitution of which was hostile both to monarchy and democracy. But we read of tyrannies so called among the Greeks in the time of Philip and Demosthenes, from which we may collect either that they had never entirely ceased to exist, or that, owing to circumstances, opportunities again occurred for ambitious individuals seizing on the sovereign power in states. Evagoras, tyrant of Cyprus, a contemporary of Isocrates, is the subject of a panegyric by that skilful rhetorician; and Plutarch, tyrant of Eretria in Eubœa, joined king Philip of Macedon against the Athenians. It was, according to the expression of Isocrates, one of the great merits of Evagoras that he raised himself from a private station to the rank of tyrant (τύραννος), which he expresses in another place as the acquisition of a kingship. (*Evag. Encom.*, c. 25, 26.)

Among the Roman writers tyrannus is often used as simply equivalent to king, especially by the poets. Cicero couples dominus and tyrannus, thereby intending to use tyrannus in a bad sense, which was perhaps the more common acceptation of the word among the Romans in his time and subsequently. Seneca seems to refer to the original sense of tyrannus when he says, 'A tyrant is to be distinguished from a king (rex) by his conduct, and not by the name: for Dionysius the elder (who was called a tyrant) was a better man than many kings; and Lucius Sulla may be appropriately called a tyrant, for he only ceased from slaughter when he had no more enemies to kill.' (Facciol., *Lex.*, 'Tyrannus.') According to this, a man might be called tyrant without being a cruel governor, for there were instances of persons so called who had used their power with moderation; and yet a man who had not the title of tyrant might be called tyrant on account of his cruelty. It seems as if Seneca was trying to distinguish the popular use of tyrant in his time from its earlier historical signification. Tribellius Pollio has written the 'History of the Thirty Tyrants' who sprung up in the Roman empire in the time of Gallienus and Valerian. These so-called tyrants were not more tyrannical, in the modern sense of the term, than many Roman emperors.

The use of the modern words tyrant, tyranny, tyrannical, has been as vague as that of most other political terms. The term tyrant is properly limited to the government of one man who is sovereign, and the popular application of the term expresses disapprobation of his conduct. Aristotle's definition of tyranny would apply well enough to a modern tyrant: he is a sovereign who looks only to his own interest, or what he considers his own interest, and cares not what he does in order to accomplish his objects. But if he were a wise sovereign, and administered the state solely with a view to his real interest, that would be found in the main to coincide with the interest of the people, and he would not be called a tyrant, though perhaps he would come within Aristotle's definition. But Aristotle's language, though apparently precise, is not so, and he means by a tyrant administering the state for his own interest, that he also administers it to the detriment of the people. As the mass judge of things by their results, a sovereign would now be called tyrannical whose administration should render his people unhappy; at least he would run great risk of having this odious epithet applied to him, whatever was the goodness of his intentions, if he failed to satisfy the people. The word tyrannical is now often applied to acts of governments which are not monarchies; but this is an improper use of the word. We may say that the laws enacted by the sovereign power in Great Britain are sometimes impolitic, unwise, or injurious to the state generally; they may also be sometimes called oppressive; but they cannot with propriety be called tyrannical, though such an expression may be and often is used in the vulgar sense of characterising a law which for some reason the person who uses the term does not like.

Confusion in the use of political terms, which is an index of confusion of thought, leads to absurdity in conduct. It is therefore a matter of some moment to clear up such confusion, which all people should try to do who presume to speak or write on matters political. A careful perusal of the following articles in this work, even if they should not be quite free from error, will put a man in the way of coming to right notions as to the meaning of ARISTOCRACY, CONSTITUTION, DEMOCRACY, LAW, MONARCH, REPUBLIC, SOVEREIGNTY.

TYRANT SHRIKES. [SHRIKES, vol. xxi., p. 415.]

TYRANTS, THIRTY. [THIRTY TYRANTS.]

TYRE. [TYRUS.]

TYRKENNEDY. [FERMANAGH.]

TYROL, a country in Germany, forming a part of the Austrian dominions, lies between 45° 40′ and 47° 44′ N. lat., and between 9° 32′ and 12° 55′ E. long. On the west of Tyrol there is a portion of the Lombardo-Venetian kingdom and of Switzerland. It is divided from Lombardy by an uninterrupted chain of high mountains, which begins at the southern extremity on the western shores of the small lake of Idro, and runs northward to the immense mass of rocks which is crowned by the Ortler Spitz. North of this mass the great chain runs westward between the Lombardo-Venetian kingdom and Switzerland, but a lateral chain, extending northward, separates Switzerland from Tyrol, and terminates on the banks of the Inn river with the steep mountains that inclose the narrow valley in which Finstermünz stands; north of the Inn river the mountain-range, known by the name of Rhaeticon, extends nearly east and west between the Inn and the Rhine, and constitutes a boundary between Tyrol and Switzerland. The remainder of the boundary is formed by the course of the Rhine to its entrance into the Boden See. [Lake of Constance.] On the north of Tyrol is Bavaria. Along this line also there are high mountains, but they do not constitute an uninterrupted chain, being broken by several streams which originate in Tyrol and flow northward into the great plain of Southern Germany. East of Tyrol are the Austrian provinces of Austria and Illyria, from which it is chiefly divided by the continuous ranges which separate the river basins of the Salza and Drau from those of the Inn and Eisack; only a small portion of the basin of the Drau is included in Tyrol. The mountains which on the south separate Tyrol from the Lombardo-Venetian kingdom are frequently interrupted by streams, which escape from the mountain region of Tyrol by very narrow valleys.

According to the latest estimates the surface of Tyrol contains 11,457 square miles, which is not quite double the area of Yorkshire, and somewhat less than three-fourths of the area of Switzerland. Tyrol is much more mountainous than Switzerland. One-third of Switzerland is an undulating or hilly plain, but Tyrol, with the exception of a comparatively small tract, is covered with high mountain-masses, on which a great number of summits rise above the snow-line and are surrounded by extensive glaciers. Level tracts, admitting of cultivation with the plough, are only found on the banks of the rivers, where they sometimes attain a width of a mile, and in a few places more, but they are usually not more than half a mile wide. All these tracts taken together do not cover one-tenth of the surface of the country; nine-tenths are occupied by the higher and lower mountain-masses of the Alps.

The Tyrolian Alps form the eastern portion of the Central or Rhaetic Alps, and do not rise so high as the Western Alps in Mount Rosa or Mount Blanc, but they are as high as the western portion of the Rhaetic Alps in Graubündten. The most elevated parts lie along the western boundary-line, south of the Inn river, and in the great chain which runs through the country from west to east, dividing the waters which run northward to the Danube, from those that flow southward to the Adriatic, or eastward to the river Drau. The western chain, as already observed, runs uninterruptedly from the Lake of Idro to the Ortler Spitz. South of 46° 8′ it does not attain the region of perpetual snow, and probably does not exceed 7000 feet above the sea-level. But near 46° 8′ it rises in Monte Adamello to more than 11,000 feet, and from this summit to the Ortler Spitz (46° 30′); hardly any portion of the range is free from snow even in the latter part of the summer. The general elevation of this range probably exceeds 9000 feet above the sea. The Ortler Spitz is the highest summit of the Rhaetic Alps, being 12,855 feet above the sea. It is surrounded by other summits, and is always covered with snow.

The deep and wide valley of the Upper Etsch (Adige), called Vintschgau, separates the mountain-masses of the Ortler Spitz from the mountain-range which traverses Tyrol from west to east. This range is divided into two high and elevated mountain-masses, which are divided by a large and wide depression of the mountain, which occurs near 11° 30′ E. long., and through which the road over the Brenner passes from Germany to Italy. The mountain-region west of this road consists of two extensive and very elevated mountain-masses, which are connected by a high ridge. The western mountain-mass is called the mountains of the Platey Kögl, or of the Great Oetzthaler Ferner, and the eastern is named the mountains of the Winacher Ferner. The mountains of the Platey Kögl occupy nearly the whole country between the Inn river on the west and the Achen river on the east, a space of nearly 30 miles from south to north, and 20 miles from west to east. A considerable portion of this tract is always covered with snow, from which rise numerous pinnacles, among which the highest are Mount Gebatsch, 12,276 feet; the Similaun Spitz, 11,859 feet; and the Great Oetzthaler Ferner, 10,434 feet above the sea-level. This is one of the most broken portions of the Alps, and the snowy masses are only furrowed by two deep and very narrow valleys. The mountains of the Winacher Ferner, or the eastern part of the region, are connected with those of the Platey Kögl by a high and narrow ridge, which only in a few places is free from snow in summer. The Winacher Mountains also rise above the snow-line, but the mass is less extensive than that of the Platey Kögl. Several summits rise above 10,000 feet, among which are the Kitzkamp, the Winacher Ferner, the Winter Stuben, and the Bock Kögl.

The depression which occurs east of the Winacher Mountains is of considerable extent, for no summit always covered with snow occurs in a space extending more than 18 miles from west to east. No summit of this part of the Tyrolian Alps probably exceeds 7500 feet in height; and in the middle, near 11° 30′ E. long., it sinks much lower: the road over the Brenner is at its highest level (47° N. lat.) not more than 4374 feet above the sea-level. This is the lowest mountain-road across the Alps, and has accordingly become the most frequented line of commercial intercourse between Germany and Italy. This road may be considered as beginning at Innspruck in the valley of the Inn, whence running in a southern direction it ascends the valley of the Sill or the Wipthal to its source near the post-house of Brenner, where it attains its highest level. Descending from it the road enters the valley of the Eisack above Sterzing, and follows the course of that river to its junction with the Etsch (Adige) below Botzen, whence it continues in the valley of Etsch, to Trent, Roveredo, Avio, and Verona. A few miles above Verona it emerges from the mountains and enters the Plain of Lombardy. Innspruck is about 1920 and Trent 960 feet above the sea-level.

East of the depression through which the road over the Brenner lies, the most elevated masses of the Tyrolian Alps do not extend over the greatest space in the direction from south to north, as is the case on the west, but constitute an elevated ground running from west to east. Towards its eastern extremity this high tract constitutes the boundary between Tyrol and the district of Salzach in Austria. It is not quite so elevated as the highest part of the western Tyrolian Alps, but it contains an almost uninterrupted series of snow-capped mountains. The highest summits appear to be the Schwarzenstein, the Drei Herrn Spitz, and the Gross Glockner, which stands where Austria, Illyria, and Tyrol are contiguous, and rises to 12,438 feet above the sea-level.

On the north-west and north of the mountain-region hitherto noticed, and separated from them by the valley of the Inn river, extends another range, which contains the sources of the rivers Lech and Isar, which descend from it northwards, and enter the Plain of Bavaria. In this range only a few summits rise above the snow-line. The highest are the Arlberg, which is 10,200, and the Great Solstein which is 9702 feet above the sea-level. West of the last-mentioned summit runs the road which leads from the Plain of Bavaria to Innspruck, and therefore is to be considered as the northern continuation of the road over the Brenner. It leaves the Plain of Bavaria at Benedictbeuern, runs through Mittenwald to the Scharnitz, near which fortification it attains its most elevated level, which hardly falls short of 6000 feet above the sea. Hence it descends to the valley of the Inn, which it reaches at Zirl, from which place to Innspruck it follows the valley.

The mountains which fill up the south-eastern portion of Tyrol are called the Carnic Alps. They begin on the south-west, on the banks of the Etsch, north-west of Verona, and extend partly within Tyrol, and partly on its boundary-line with the Lombardo-Venetian kingdom, in a north-eastern direction to the source of the river Drau, where they turn to the east and leave Tyrol. Very few summits of this extensive mountain-region reach the snow-line. The most elevated is Monte Marmolata, which rises to 11,500 feet above the sea-level. The connection between this range and the Eastern Tyrolian Alps is formed by a moderately elevated and narrow ridge, which occurs near 12° 12′ E. long., and separates the sources of the Drau, which flows eastward, from those of the river Rienz, which runs westward and joins the Eisach at Brixen. On the north this ridge is connected with the extensive snow-masses and glaciers which occur south of the Drei Herrn Spitz. Over this ridge runs the road which connects Tyrol with the remainder of the Austrian state. It begins at Brixen, where the Eisach is joined by the Rienz, ascends the valley of the Rienz to Toblach, traverses the above-mentioned ridge east of Toblach, and descends into the valley of the Drau to Innichen, in which it continues to Lienz and Illyria. From this another road branches off to the southward, which leads over the Pentelsteiner Pass to the plain of northern Italy. It leaves the road at Tob lach, and runs in the valley of the Rienz southward to its source, which is at the foot of the Pass of Pentelstein. The highest level of the road does not appear to exceed 5000 feet. South of the mountain-pass it enters the Valley of Ampezzo, the river of which runs to the Piave, and which valley opens into the valley of that river below Piave di Cadore. Hence the road traverses the lower mountains which lie east of the valley of the Piave, and runs through Caneda, Conegliano, and Treviso to Venice. This road is a part of the shortest road which leads from the Plain of Bavaria to the Adriatic.

The mountain-road over Monte Stilvio, or the Stilfserjoch, was constructed by the Austrian government between 1820 and 1825, for the purpose of establishing a direct communication between Tyrol and the Valtelin. This road passes over the elevated and snow-covered mountain-masses which lie north-west of the Ortler Spitz, and its highest level rises to 9174 feet above the sea, or nearly 1500 feet above the snow-line. It is the loftiest carriage-road in Europe: but, according to the latest information, the galleries constructed for the purpose of defending the road against the avalanches, which at certain seasons descend from the adjacent mountains, have proved insufficient, and have repeatedly been broken down by the immense masses of snow, and the road has been abandoned.

The largest rivers of Tyrol are the Inn and the Etsch. The Inn rises in the western part of the Rhaetic Alps in Engadin [ENGADIN], and runs about 50 miles before it enters Tyrol by a very narrow valley at Finstermünz. Its course within Tyrol is about 100 miles, and it becomes navigable for small river-boats at Telfs, about 20 miles above Innspruck, and for larger river-boats at Hall, about 8 miles below Innspruck. Below Kufstein it leaves Tyrol and enters Bavaria. The Etsch originates in the mountains west of the Ortler Spitz, and runs to the eastward until it is joined by the Passeyner rivulet, when it turns to the south-east. At its junction with the Eisach below Botzen it turns southward and begins to be navigated. At Borghetto it leaves Tyrol and enters the Lombardo-Venetian kingdom. The navigation of these rivers is difficult, and frequently interrupted by their rapidity, especially after the melting of the snow in the mountains.

As a great portion of the country, probably one-tenth, is always covered with snow, whilst its most southern valleys are hardly 500 feet above the sea-level, the climate of Tyrol must differ greatly in different places. At Innspruck the mean temperature of the winter is 30·5°, or nearly 8° less than at London; and that of the summer is 64°, or about 2½° more than at London. The mean annual temperature is 49°, or 1° less than at London. At Trent the mean annual temperature is 53°, or nearly 3° higher than at London.

All those parts which on the north are 7500 feet, and on the south 8500 feet above the sea-level, are always covered with snow. Lower down, to an elevation of 6000 feet above the sea, snow is found all the year round in places which are not much exposed to the sun, but in other places the declivities of the mountains are covered with grass and flowers. In the region between 6000 and 5000 feet trees do not grow, but there are some bushes, between which the soil is covered with grass that serves for pasture during two or three months in summer. There are no houses inhabited all the year round at this elevation. Fir-trees occur only at an elevation of between 5000 and 4000 feet, where a few permanent habitations are found, and some potatoes and vegetables are cultivated. The winter lasts in this region eight or nine months. Agriculture is carried on with success in all places below 4000 feet. Rye and barley are grown, and potatoes to a considerable extent, though they do not grow large when planted above 3000 feet. Apple and pear trees succeed at the elevation of 4000 feet, and even somewhat higher, but plum-trees only to 3800, and walnut-trees to 3600 feet. The beech is found between 3000 and 4000 feet, and the oak between 1800 and 3000 feet above the sea-level. Wheat does not succeed above 3000 feet, and vines only between 800 and 1800 feet.

In Tyrol, owing to the great unevenness of the surface, the air is in continual motion, and a calm day is a rare occurrence. The southern winds are like the sirocco of Italy, much feared on account of the effect that they produce on the health, especially in the southern valleys. They are most frequent towards the end of summer and in the beginning of autumn, and dissolve in a few hours an immense quantity of snow, which about that season begins to cover the less elevated mountains, and the volume of water which is thus conveyed to the rivers produces extensive inundations in some parts of the valleys. The most fertile lands are in the valleys of the Inn and of the Etsch; the valley of the Etsch is the most fruitful.

Wheat, rye, barley, and oats are cultivated where the climate or stony soil is not unfavourable. In some parts buckwheat is grown to a great extent, and used for bread. Millet is also grown, but not extensively. Indian corn is the principal object of agriculture in the valleys on the border of Italy, and potatoes are nearly as much cultivated as in the northern. Hops grow wild in the southern districts, but they are little cultivated. Tobacco is grown to some extent in the southern valleys. Flax and hemp are cultivated everywhere, but not extensively. Fruit-trees abound in the southern valleys, and large quantities of fruits are exported to Bavaria. Near Trent are plantations of fig-trees, and at Roveredo chestnuts are very common. In these parts are also plantations of olive-trees and mulberry-trees. A considerable quantity of silk is annually collected. On the banks of the Lago di Guarda are plantations of oranges, whose fruits get quite ripe. Wine is made in large quantities, and some sorts are very good, but they do not keep.

Cattle are of middling size and rather numerous; horses are less abundant, and better for the draught than for the saddle. Sheep are very numerous, and in later times some attention has been paid to the improvement of the breed. Goats are more common than in any other part of Austria, but pigs are not much kept. Fowls, geese, and ducks are not plentiful. There are chamois, hares, marmots, and partridges; and there are some large birds of prey, especially eagles.

Gold is found in small quantities; silver is somewhat more abundant. Copper also occurs; lead is more abundant: iron also abounds, but it is less worked than would be the case if the mines in Illyria were not much richer. Calamine is found and worked at a few places: coal also is worked to some extent. There are productive mines of rock-salt near Hall, about eight miles below Innspruck. In the southern districts there is a valuable kind of marble, resembling that of Carrara, which is much worked.

(Rösch, *Die Schweitzer Alpen*, in Berghaus's *Almanach*, 1841; Hoffmann, *Deutschland und seine Bewohner*.)

Manufactures and Trade.—Though the inhabitants are extremely industrious, and have a remarkable talent for mechanical arts, Tyrol is not a manufacturing country. The women spin flax, weave linen, knit caps and stockings, make baskets and straw hats; they make wooden ware for sale, and Bregenz formerly reared great numbers of canary-birds as objects of commerce. Some towns manufacture goods of various kinds, as Bregenz, Roveredo, Ala, and Innspruck. It is remarkable that some valleys confine themselves to one branch of industry, in which they excel. The trade of Tyrol is considerable, especially the transit trade, which is much facilitated by the admirable new roads. Besides the export of the natural productions of the country, thousands of the inhabitants annually migrate as pedlars or hawkers, with gloves, carpets, carvings in wood (from Gröden), and engravings; the trade in canary-birds has nearly ceased. The Tyrolese have a remarkable talent for the fine arts: Pilcher, one of the most eminent of modern lapidaries; Troger, one of the best fresco painters of the eighteenth century; the sculptors Schöpf and Zeuner, Sir G. Kneller and Angelica Kauffman, were natives of Tyrol. The Tyrolese have likewise a good genius for mechanics, which wants only to be well directed and more encouraged. Education has been much extended within these few years. In 1833 there were 1564 schools, including 12 high schools, 36 schools of industry, and 12 schools of design. Of 110,856 children of an age to go to school, 108,586 actually attended. Besides these there are eight gymnasia, a lyceum, two seminaries, and a university at Innsprück. The beneficent and charitable institutions are numerous and well-conducted.

Population.—According to returns made in the years 1829 to 1832, the population had been progressively increasing, and was in the latter year 813,000, of whom above 600,000 were Germans and the remainder Italians. They are all Roman Catholics. The population may now be 830,000.

Character, Manners, and Language.—The character of the Tyrolese has many peculiarities which distinguish them from all their neighbours. They are honest, frank, with a very independent spirit and a nice sense of honour, and strong attachment to their native land; the object of the numerous emigrants being merely to save a small capital, to enable them to buy a piece of land at home. They are especially distinguished by their devoted attachment to their sovereign, the emperor of Austria. They are fond of the chace and of manly games, and are a poetical and musical people. They are said to be immoderately fond of spirituous liquors. Even the girls smoke tobacco, and chewing tobacco is general. To their love of brandy, of prize-fighting, and of satirical songs may be ascribed the many affrays, often attended with the infliction of dangerous wounds, which are more numerous in Tyrol than in all the other provinces of the empire together. The above remarks apply only to the German population. The inhabitants of Southern Tyrol have more of the Italian in their manners, language, and even in their dress, while the North retains more of the antique character.

History.—At the earliest period to which we can trace the history of Tyrol it formed part of Rhætia, and was subdued by the Romans in the reign of Augustus. After being ravaged by successive hordes of barbarians, the Marcomanni, the Alemanni, the Huns, and the Goths, it was divided into several petty lordships, all of which acknowledged the supremacy of the princes and dukes of Bavaria. In the twelfth century, on the fall of the house of Guelph, the Tyrolese became immediate subjects of the empire, and the petty lordships were absorbed under two heads: the two families being united by marriage, the country was governed by one sovereign, the last of whom dying in 1335, left one daughter, Margaret Maultasche, who made over her dominions to her cousins the dukes of Austria. Austria, after having remained in possession of it several centuries, was compelled to cede it by the peace of Presburg, in 1805, to Bavaria. Attached as the people were to the house of Austria, and to their constitution, which was remarkably free, they were dissatisfied with the change of masters, and still more with the measures of the Bavarian government. Accordingly, when war between France and Austria again broke out in 1809, the whole province rose in arms, under Andreas Hofer, but the great disasters of Austria left them without support, and the country was again occupied by the French and Bavarians, in whose possession it remained till 1814, when, to the great joy of the people, they were restored to the dominion of Austria, and reinstated in all their antient privileges.

Trent, the chief town of the circle of the same name, is situated on the navigable river Adige, in a beautiful and fertile valley which is surrounded with high mountains. A traveller coming from Germany is much struck with the appearance of this city, which has quite an Italian character: the houses are very high, with flat roofs, the streets tolerably wide, and well paved with broad flag pavement for pedestrians. There are many handsome buildings in the city, and some churches worthy of notice. Among the former are the theatre, the episcopal palace, and the palace of Tertaga Tabarelli, built of red marble by Bramante d'Urbino: of the thirteen churches the most remarkable are the cathedral, a large edifice in the old Greek style, entirely of marble, the building of which was begun in the tenth century and finished in the sixteenth; 2, Santa Maria Maggiore, built entirely of red marble, with an extremely lofty chapel, which is much admired, and is memorable as having been the place in which the Council of Trent held its sittings from 1545 till 1562; 3, the church of the seminary (formerly belonging to the Jesuits), adorned with a profusion of costly marble; 4, the church della Annunziata, the lofty cupola of which is supported by immense pillars of red marble, each consisting of a single block. Some of the churches and palaces have fine paintings. Signor Grovanelli has a remarkable collection of medals and antiquities, mostly found in South Tyrol. Trent is the residence of the prince-bishop, with a chapter of eight canons. The city has 12,000 inhabitants, whose occupations are the silk manufacture and the cultivation of the vine. There are in the city extensive sugar-houses, a large imperial tobacco manufactory, and many distilleries of brandy and spirits of wine. Among the public institutions are a gymnasium, a lyceum, a Franciscan and a Capuchin convent, and various hospitals and poor-houses.

Roveredo is situated in the middle of the pleasant Lazarina valley, which is planted with vines and mulberry-trees, on the river Leno, which flows through the town, and at a short distance from the left bank of the Adige, over which there is a stone bridge. The town, though not large, has many handsome houses, mostly built of marble. The new street, Corso Nuovo, in particular is adorned with fine edifices: the theatre stands at the beginning of this street. The castle, which is surrounded with high walls, is worthy of notice. The town is the seat of several courts of justice, and has a gymnasium, three monasteries, an English convent with a school for girls, a public library, and some charitable institutions. The inhabitants, about 16,000 in number, manufacture silk, leather, and tobacco, and have a considerable trade in silk and twist: 200,000 lbs. of silk are annually exported. In 1487 Roveredo was taken by storm by the archduke Sigismund, in sight of the whole Venetian army. On this occasion bombs were used for the first time.

Botzen, Bregenz, Brixen, Innspruck, and **Schwatz** are described under their respective names.

(Brockhaus, *Conversations Lexicon*; Blumenbach, *Gemälde der Oesterreichischen Monarchie*; *Die Oesterreichische National Encyclopädie;* R. v. Jenny, *Handbuch für Reisende durch Oesterreich*, edited by A. Schmidt.)

TYRONE, an inland county in the province of Ulster, in Ireland, bounded on the north and north-east by the county of Londonderry, on the east by Lough Neagh, on the south-east by the county of Armagh, on the south by that of Monaghan, on the south-west by that of Fermanagh, and on the west and north-west by that of Donegal. Its form approximates to that of an oblong quadrangle, with its sides facing the north-east, south-east, south-west, and north-west respectively. The largest dimensions, which are the diagonals of the quadrangle, are as follows: from the shore of Lough Neagh at the mouth of the Ballinderry river in the east, to the border of the county of Donegal in the west, 57 miles; and from the banks of the Foyle, at the junction of the three counties of Tyrone, Donegal, and Londonderry in the north, to the junction of the three counties of Tyrone, Armagh, and Monaghan in the south, 47 or 48 miles. The area (including that part of Lough Neagh which is assigned to this county) is, according to the Ordnance Survey, 806,295 acres, 3 roods (or nearly 1260 square miles), of which 774,500 acres, 2 poles (or 1210 square miles) are land; and 31,795 acres, 2 roods, 38 poles (or nearly 50 square miles) are water. The population, in 1831, was 304,468, giving nearly 242 inhabitants to a square mile. In area it is about equal to the English county of Gloucester, but falls considerably short of it both in amount and density of population. Omagh, the assize town, is 96 miles in a direct line north-north-west of Dublin, or 110 miles by the Londonderry mail road through Ashbourne, Slane, Carrickmacross, Castle Blayney, Monaghan, and Aughnacloy; in 54° 36′ N. lat. and 7° 19′ W. long. The county itself lies between 54° 19′ and 54° 57′ N. lat., and between 6° 35′ and 7° 56′ W. long.

Surface, Geology, Hydrography, and Communications.—This county lies, for the most part, between the two mountainous districts which cross Ulster from east to west. The northernmost of these districts (that of Antrim, Londonderry, and Donegal) encroaches upon the northern border; and the southernmost (that of Down, Armagh, Monaghan, and Fermanagh) encroaches on the southern border. Outlying groups of mountains occupy portions of the intermediate district, especially on the west, where they extend nearly across the county. Another group, connecting the two great mountain-districts, crosses the county a little to the eastward of the centre, and divides the lower ground, which occupies most of the central and eastern parts of the county, into two parts; the plain or basin of Omagh in the centre, and the plain of Lough Neagh on the east.

The plain of Lough Neagh (the surface of which lough is nearly 50 feet above the level of the sea) rises gradually from the shore of the lough westward towards the mountains which separate it from the plain of Omagh: it extends south-eastward across the border of the county, which is here formed by the river Blackwater, into the adjacent county of Armagh; and south-westward to the neighbourhood of Clogher and Five-mile-town, to the foot of the mountains which border on the county of Fermanagh: northward it extends along the shores of Lough Neagh into the county of Londonderry.

The part of the plain adjacent to the lough, and to the river Blackwater as far up as Charlemont, is occupied by tertiary formations, probably lacustrine, consisting of beds of white, brown, and greenish-blue clay, alternating with white and grey sand: they have been bored in some places to the depth of 294 feet without reaching the subjacent formations. Irregular beds of lignite occur, and this mineral is dug by the inhabitants, when other fuel is scarce, for their domestic use. This clay district is similar to that of Bovey in Devonshire; but no good white potters' clay has been found, though several pits have been opened both for potters' clay and pipe-clay. To the north-west of the tertiary beds, the secondary formations, chalk, greensand, and lias, crop out, being covered in places by masses of tabular trap. These are succeeded by the red marl or new red-sandstone, which on the south-west immediately succeeds the tertiary beds. Between Dungannon and Stewart's-town is a coal-field which, though small, contains more beds of workable coal than any other in Ireland, and affords coal similar to that of Ayrshire. There are collieries at Drumglass near Dungannon, and at Coal Island, nearly midway between Dungannon and Stewart's-town. The formations of the limestone group (corresponding in geological position to the carboniferous or mountain limestone of England) occupy nearly all the remainder of the plain, and extend south-westward to the neighbourhood of Clogher, where, contrary to its general character in Ireland, it rises into tolerably lofty mountains. The limestone mountain south of Clogher, known as Slievh Beagh, rises to the height of 1254 feet.

The plain of Lough Neagh is drained by the Ballinderry in the north, and the Blackwater in the south; both have the upper part of their course in the county and the lower part on the border; the length of the Ballinderry is about 25 miles; of the Blackwater, 46 miles. The latter is navigable for about eight miles, namely, below Charlemont, where the Ulster canal, which skirts its course on the Armagh side for many miles above the junction, opens into it. A canal, five miles long, conveys the produce of the Coal Island collieries into the Blackwater.

The plain of Omagh is inclosed on nearly every side by mountains: it extends to the south-west into the county of Fermanagh, to the border of Lough Erne; and to the north-west, to the border of the county of Donegal; and is drained by the streams which unite to constitute the Foyle. The eastern and southern part of this plain, and the extension towards Lough Erne, are occupied by the old red-sandstone, which abuts upon and in some places covers the granite and protruded greenstone which form the mass of the mountains that separate the two plains of Lough Neagh and of Omagh. The rest of the plain of Omagh and the mountains which on other sides environ it consist of mica slate, covered in extensive tracts by the old red-sandstone, by the different members of the carboniferous limestone series, or by the millstone-grit. There are some quarries of inferior slate. Freestone and limestone are quarried in various parts of the county; the limestone of Cookstown is remarkable for the number and variety of its fossil remains.

The Camoan, or Camowen, the principal of the streams which unite to form the Foyle, rises in the mountains that separate the plains of Lough Neagh and Omagh, and flowing westward to Omagh, receives the Drumragh from the southern part of the county: it then turns northward, and flows by Newtown-Stewart to the border of the county at Strabane; and after separating for some miles Tyrone from Donegal, finally quits the county to enter that of Londonderry. Its whole length, including Lough Foyle, is about 76 miles, of which above 50 are in this county or on the border. It takes the name of Strule soon after its junction with the Drumragh; below the junction of the Derg it is called Mourne, and finally, below the junction of the Finn, Foyle. It is navigable below Newtown-Stewart, about 30 miles from its source. Its chief tributaries in this county are the Drumragh and the Derg on the left bank, and the Owen Killew on the right bank. At Strabane it receives the Finn from the county of Donegal, which is navigable to Stranorlar, and has the last four miles of its course on the border of this county. The Strabane canal runs from the town of Strabane about three miles into the Foyle, to which river its course is parallel.

The lakes are numerous; but are all small except Lough Neagh, of whose surface 27,355 acres, 1 rood, 28 poles, or nearly 43 square miles, are assigned in the Ordnance Survey to this county.

The Dublin and Londonderry mail-road crosses the country from south-east to north-west by Aughnacloy, Ballygawley, Beragh, Omagh, Newtown-Stewart, and Strabane; the Newry and Coleraine cross-mail road crosses the eastern side of the county, through Moy, Dungannon, and Cookstown.

We subjoin the height of some of the more remarkable elevations: Slievh Sawel, 2236 feet; Mullagh Clogher, or Straw Mountain, 2083 feet; Oughtdoorish, 1866 feet; Carnakilly, 1596 feet; Slievh Kirk, 1225 feet; and Fir Mountain, 1118 feet; all on or near the border of the county towards Londonderry. Dooish, in the mountain group which bounds the plain of Omagh on the west, 1119 feet; Mullagh-carn, 1778 feet; Bessy Bell, 1386 feet; Slievh Ard, 1381 feet; and Mary Gray, 826 feet: all north of the plain of Omagh. The hills north-east of the plain of Omagh, between the Owen Killew and the Glenelly, feeders of the Camoan, rise to the height of 1432 feet. The measurements are from the Ordnance Survey.

Agriculture, State of the Population, &c.—The following particulars, borrowed from the Appendix to the First Report of the Irish Poor Commissioners (*Parl. Papers for* 1836, vols. xxxi.-xxxiii.), relate to the barony of Omagh, which has an area of 224,675 acres, or 351 square miles, being more than a fourth of the whole county. We quote the observations of Jonathan Binns, Esq., one of the Commissioners, 'On the Nature and State of Agriculture.'

'The soil of the barony of Omagh is mostly of a light friable nature, and of a brown colour, upon a firm, loamy subsoil, mixed with gravel, and in some places upon a sandstone, and others upon a slaty rock. Limestone is found at Kilmore, near the town of Omagh, at Drumquid, and on the borders of the county of Fermanagh. Peat bogs and mosses abound in all parts of the barony; in their vicinity the land is of a moory or peaty nature upon a clayey subsoil.

'The agriculture in this barony is very far behind that of the county of Armagh, or any other we have visited. The principal landlords are absentees, and do not encourage improvements; many of the farmers are ignorant of the cultivation of turnips, clover, rape, or mangel-wurzel: some of them say they are aware of the advantage they would receive by these plants, but they are too poor to get lime, manure, or sand to begin the system. Their plan is to grow a succession of oat crops (sometimes five), after potatoes, till the land can no longer produce, and in that exhausted state it is left to rest, as they term it, till it is ready for a repetition of this scourging process. The pasture afforded in the interim, left as it is in many or most cases to spontaneous production, is poor in the extreme; some few sow a little white-grass (*Holcus lanatus*). Rye-grass and timothy-grass are sown in a very few instances, and a little clover. It is said there is no Agricultural Society in the county of Tyrone. The farms average about 12 acres Irish measure. Two-thirds are ordinarily under the plough. The rent of the arable land, keeping the high land near the mountains, is 1*l.* 10*s.* per acre, Irish; the tithe, 1*s.* to 2*s.* 6*d.*; the county cess, 3*s.* to 4*s.* per acre. Many have leases, but without any instruction for proper cultivation, and, on the other hand, without any condition on the part of the landlord to assist the tenant in draining, limeing, building, fencing, &c., as is the usual practice in many parts of England. Notwithstanding, it is usual for the farmers to burn lime, as the number of limekilns in all parts of the barony testify. The limestone at Kilmore costs, at the quarry, 2*s.* per ton; when burned, it is charged 10*d.* per barrel of four bushels. The farmers prefer carting the stone and burning it in kilns with sods or turf on their own farms; this they do at vacant times: the breaking and burning cost 8*d.* per ton, therefore 2*s.* 8*d.* per ton is all the farmer is out of pocket, the rest is his own cartage and labour in stone, turf, &c.: 30 or 40 barrels are put on land which has been previously arable, and double this number is laid on rough, unbroken-up ground: from 100 to 120 of these barrels are frequently laid on the latter kind of land in Lancashire and the adjoining counties. Many of the farmers make composts of lime, earth, peat, clay, mud, and dung, and are generally careful to put some peat or other absorbent into their midden-steads, or yards, but they never can have a sufficient supply of manure till they adopt the system of keeping their cattle on green food in the house. Another proof of the advantage of cutting green food for cattle, and keeping them in the house, may be adduced by comparing the quantity of butter given by the same description of cow under the two modes of feeding. In Omagh they state the quantity to be 60 to 70 lbs. in the year: in Armagh, under the stall-feeding, it is 100 to 112 lbs. The old Irish breed prevails here almost exclusively, no improved breed having been introduced.

'Sheep are rarely seen; we observed on an average about one in a mile, in travelling through most parts of the barony: except in demesnes, it was said by the farmers that there was one sheep to about 20 acres. The pigs in this barony, as well as in the other parts of Ireland which we have visited, are of a good description. The horses are also useful, and adapted to the country and the small farms. The car is still in use here, with the revolving axletree and solid wheels: there is also a species of carriage quite novel to me, viz. a sledge, or as it is here called, a sled or slide: it consists of the shafts of a cart, having nailed to each of them at the lower end a piece of crooked wood, a yard or four feet long, to slide upon the ground; upon these shafts a basket is placed to carry turf, hay, &c.; these sledges are used on the mountain-sides, being lighter to draw up the steeps of the hills, and less subject to be overturned. They do not appear to be aware of the convenience so general in England of what are called shelvings, viz. a simple slight projecting rail, extended round the cart for the purpose of carrying a load of hay or straw.

'The ploughs have been much improved; the old clumsy wooden plough, with its wooden mould-board, has given place to the Scotch and iron plough, with a pair of horses abreast. Their spades and shovels differ from the English in having handles five or six feet long, which are certainly calculated for keeping the body more erect, and for ease in their use, and in some cases may be as useful, but the English spade and shovel are in my opinion calculated for doing more work in a given time. Although the roads in every direction were receiving great injury from the accumulation of water and mud upon them, we did not see half a dozen men employed at them during the ten days we were residing in and travelling in the barony; that is, we did not six times see any man employed upon them. It is notorious that so many poor men are forced to be idle, though so anxious to get a day's work, that they would travel six or seven miles for it, according to the evidence given at Armagh. A little labour in opening the sides to allow the water to run freely off, scraping the mud off, and putting a few stones into the hollows, saves the great expense which is very commonly resorted to in covering a road entirely with broken stones, rendering it almost impassable for a long time. Many of the roads which are not turnpike are in a most neglected and shameful state, but the farmers say that they cannot adopt any proceedings, and therefore must submit.

'Very little attempt appears to be made to cultivate the surface of the bog-lands; what is done is chiefly by hand-labour: no horses are used upon mosses or bogs, with pattens to prevent them sinking, as practised in Lancashire. Potatoes are all grown on the ridge or lazy-bed method; not a single instance occurred where the plough was used. Wheat is very little grown, which may be in part accounted for by the distance to any port or water-conveyance: what is produced is carted to Caledon or Derry, a distance of 30 Irish miles: many parts of the barony and county are well adapted to its growth under proper cultivation. At Omagh there is a good market for oats. Very few orchards are to be found.

'Many of the enclosures are large for the size of the farms, and the fences so bad, that they are obliged to bring all their cattle into the house at night, often without food, and attend them by day. In more parts quickset fences have taken the places of whins and mounds of earth, but in these cases the tenants have had to purchase the thorns and plant them, which are not very dear, say 3*s.* to 5*s.* a thousand. It is allowed by all that the farmers are becoming very poor, and less able to make any improvement: the situation of the cottier is deplorable, living, or, more properly, merely possessing an existence, in poverty, rags, and wretchedness, in dwellings not fit for a human being, frequently without windows or chimneys, built of sods or mud, 12 or 14 feet square, imperfectly covered with rushes or straw, the smoke issuing out of the door and various parts of the roof.'

The Irish acre is equal to 1 acre 2 roods 19 $\frac{41}{121}$ poles statute measure; and the Irish mile to 1 mile 2 furlongs 7 poles.

The cultivation of potatoes has increased. There is no permanent grass-land. The butter of the district is of second quality, but it has improved considerably of late years. Very little cheese is made.

The con-acre system is by no means so general in the county as in many parts of Ireland: in a great number of parishes it is quite unknown.

Farm servants, unmarried and living in their masters' houses, receive, according to their skill, from 5*l.* to 7*l.* a year besides their living. Day-labourers in and about the towns are generally without regular employment, and form the most destitute class. Cottier labourers are the most numerous class. These give the first four days' labour out of every week throughout the year to a farmer, for which they receive from the farmer the following payment:—their food on the days when they work for him; a cabin and from 15 to 20 perches of manured land for potatoes; as much land as will be sufficient for sowing two pecks of flax; and permission to cut as much turf as two men can cut with spades in a day, which turf is brought home for them by the farmer. In some cases they get a little ground, perhaps half a rood, for oats: the remaining two days of the week are considered necessary for the cultivation of their own little crop, out of the proceeds of which they have to clothe themselves and their families, to feed those families all the year round, and themselves three days out of every seven. This difficult task they are enabled to perform chiefly by the industry of their families in the dressing and sale of their flax and by rearing a pig. When a cottier is old, and unable to work as the farmer wishes, he must go out and beg, unless he has a family able to maintain him. If sick and unable to work, his crop is seized, and perhaps sold; or if, by the kindness of the farmer, his crop is left, he has to make up the lost time by additional labour when restored to health. Some cottiers get the privilege of keeping a cow on the farmer's land, for which they pay 4*l.* 4*s.* a year, which is generally paid in money.

Employment is scarce: day-labourers seldom get more than half work through the year, and many do not get even that: a labourer gets in summer 8*d.* per day and his diet; in winter, when employment is very scarce, 5*d.* per day and diet: a boy under sixteen may earn about 1*l.* 10*s.* in the half-year as servant to a farmer. A cottier's wife may earn 1½*d.* a day by spinning, at the utmost: children in general get no employment till they are twelve or fourteen years of age. The food of the labouring class consists chiefly of potatoes, and part of the year of oatmeal. Their cabins, which have been described already, are wretchedly furnished; their clothing also is wretched. Turf is the common fuel, and is abundant and cheap; yet, amidst all their privations, they are, on the whole, a peaceable well-conducted people.

Divisions, Towns, &c.—The county is divided into four baronies, as follows:—

Baronies.	Situation.	Area. Land. A.	R.	P.	Water. A.	R.	P.	Total. A.	R.	P.	Population in [illegible]
Clogher	S.	97,271	2	11	297	3	32	97,569	2	3	[illegible]
Dungannon	E.	215,452	1	22	28,109	0	5	243,561	1	27	[illegible]
Omagh	Centr. & W.	223,519	2	29	1,155	0	18	224,674	3	7	[illegible]
Strabane	N.	238,256	1	20	2,233	2	23	240,490	0	3	[illegible]
		774,500	0	2	31,795	2	38	806,295	3	0	[illegible]

The county contains the assize-town of Omagh, the borough of Dungannon, the ex-boroughs of Strabane, Augher, and Clogher [CLOGHER, BISHOPRIC OF], disfranchised at the Union; the market-towns of Aughnacloy, Ballygawley, Beregh or Beragh, Caledon, Castlederg, Cookstown, Drumquin, Fintona, Moy, Newtown-Stewart, Stewarts-town, and Trellick; and the post (but not market) towns of Coal-island, Dunamanagh, and Five-mile-town.

Omagh is in the parish of Drumragh, in the barony of Omagh. It is thought to have owed its origin to an abbey founded near the close of the eighth century. It is on the south bank of the Camowen, immediately below the junction of the Drumragh; and consists of one principal street, nearly parallel to the course of the river, and one or two smaller streets branching from it. The streets are paved, but not lighted. There were, in 1831, 297 inhabited houses, with 371 families, and a population of 2211: the houses are mostly of respectable appearance, and slated. The parish church of Drumragh, a large and handsome building, with tower and spire, is in the town; and there are a Roman Catholic chapel, two Presbyterian meeting-houses, and one Methodist; a handsome court-house for the assizes, a county gaol, barracks for the military and for the police, the latter just over the bridge, in Cappagh parish; a county infirmary, a fever hospital, a dispensary, a savings-bank, and a news-room. The town has not much trade: there is an extensive brewery in Cappagh parish, just across the river. There is a well-supplied market on Saturday, but the corn-market is inconsiderable, except for oats. Brown linens are sold on alternate Saturdays, and there are ten fairs in the year.

Dungannon is in Drumglass parish, in the barony of Dungannon, 97 miles from Dublin, on the branch mail-road from Newry to Coleraine. It was antiently one of the chief seats of the Hy Nial or O'Neill family, and suffered considerably in the early hostilities between the native Irish and the English of the Pale, as well as in the great rebellion of 1641 and the war of the Revolution. The town consists of four principal and some smaller streets, and had, in 1831, 569 inhabited houses, with 708 families, forming a population of 3515. The town is lighted with gas, and has many good houses both in and round it. It has a castle, rebuilt after the Restoration; the parish church of Drumglass, a handsome building, with a lofty octagonal spire; a Roman Catholic chapel, two meeting-houses for Presbyterians and one for Methodists, and a court-house and bridewell. The principal trade of the town is the manufacture and bleaching of linen; in the immediate neighbourhood are several limestone-quarries, some potteries, iron-works, lime-works, and flour-mills, a large distillery, and a brewery; and at Drumglass, only a mile distant, are collieries. Dungannon was incorporated by charter of James I., A.D. 1612; but the corporation has been dissolved by the late Irish Municipal Reform Act. It sends one member to Parliament. Dungannon has a well-endowed royal college or school, with (in 1834) nearly 80 boys; the school-buildings, which cost 4626*l.*, were erected A.D. 1786, by order of primate Robinson of Armagh, who gave the ground and 2000*l.* towards the expenses. Near the town is Northland House, the residence of Lord Ranfurly.

Strabane, in the barony of Strabane, 18 miles north-north-west of Omagh, on the Londonderry road, consists of a number of streets irregularly built on the north-east or right bank of the Mourne, a little above the junction of the Finn. A bridge over the Mourne connects the town with a smaller part or suburb of the town on the opposite bank of the river, and another bridge, a mile distant, over the same river (which here, below the junction of the Finn, is called the Foyle), connects it with the town of Lifford in the county of Donegal. The houses, which are generally well-built, and many of them handsome, amounted in 1831 to 775, inhabited by 871 families; the population was 4700. The parish church of Camus parish (in which part of the town stands) is in Strabane; and there are two Roman Catholic chapels, one of them in the suburb beyond the river, and one meeting-house, if not more, for Presbyterians or Methodists, and a court-house and bridewell. Corn (for which Strabane has the most important market in the county), salt beef and pork, butter, eggs, and poultry, are exported; and timber, staves, iron, groceries, and general merchandise imported. There is a considerable brewery, and on the Foyle, below the town, is an important salmon fishery. Trade is facilitated by the Strabane canal, the basin of which is adjacent to the town, and has good wharfs and quays, with warehouses and storehouses for grain. Strabane was incorporated by charter of James I.: the corporation has been dissolved by the late Irish Municipal Reform Act.

Augher is in the barony of Clogher, about 16 miles south-south-east of Omagh, and about two miles north-east of the town of Clogher. It stands on the south side of the river Blackwater, and consists of one small street and a group of houses detached from the street. Near the town are the remains of an old castle. There is a market-house, in which divine service is performed every Sunday. The town was incorporated by James I., but the corporation has gone into disuse. The population of the town and immediate vicinity was, in 1831, 832, chiefly Protestants.

Aughnacloy, in the barony of Dungannon, and Ballygawley, in that of Clogher, are both on the Dublin and Londonderry mail-road. Aughnacloy is 20 miles S. E. from Omagh, and Ballygawley 16 miles. Aughnacloy (population in 1831, 1742) consists of one principal street along the mail-road, and of some smaller streets. It contains some good houses, the parish church of Carrenteel, a Roman Catholic chapel, a Presbyterian meeting-house, and a convenient market-house. The market is on Wednesday, and there is a monthly fair for live stock. Ballygawley (population in 1831, 972) consists of one principal street along the mail-road, and has some large and well-built houses, the parish church, and a Presbyterian meeting-house. A small manufacture of gloves is carried on, and there are a brewery and a distillery. The market is on Friday, and in it every fortnight there is a considerable sale of linen. There is a monthly fair for live-stock. Caledon is in the barony of Dungannon, between Armagh and Aughnacloy, on the left bank of the Blackwater, and at the south-eastern extremity of the county. It consists of one main street, and had in 1831 a population of 1079. The parish church of Aughaloo is in the town, and there are a Roman Catholic chapel and a Methodist meeting-house; near the town is Caledon House and demesne, the residence of the earl of Caledon. There is a large flour-mill, and round the town are a number of limestone-quarries. Caledon was antiently called Aghaloo or Aughaloo, and at a later period Kennard, which name is still frequently used by old people. Castlederg, or Derg-bridge, is in the barony of Omagh, on the north or left bank of the Derg, over which is a handsome stone bridge of four arches. West of the town are the ruins of an old castle, built before A.D. 1619, by Sir John Davis, attorney-general for Ireland. Population in 1831, 575. Cookstown, in Dungannon barony, consists of one street above a mile long, on the mail-road from Newry to Coleraine. It had in 1831 a population of 2883. Many of the houses are large, built of stone and slated. The parish church of Derryloran is in the town, and in or near the town are several meeting-houses and a large Roman Catholic chapel. There are two weekly markets, one on Tuesday for corn, and one on Saturday for linen-cloth and yarn, flax, live-stock and provisions, and a monthly fair for farming-stock. Near the town are a bleach-mill and a number of limestone or freestone quarries. Fintona, in the barony of Clogher, on a feeder of the Drumragh, nine miles S. by W. of Omagh, consists of one main street, with some well-built houses. The population in 1831 was 1714. Unbleached linens are woven and sold in considerable quantity in the market, which is held on Friday. The parish church is in the town: the Roman Catholic chapel is at some distance from it. Moy is in the barony of Dungannon, on the Newry and Coleraine mail-road, just where it enters the county, on the banks of the Blackwater, over which is a bridge communicating with the town of Charlemont in Armagh. Moy had in 1831 a population of 902. It consists of a principal street, expanding in one part into a square or market-place, and of one or two smaller streets branching from the market-place; and contains the parish church, a Roman Catholic chapel, several Dissenting meeting-houses, and a commodious market-house. Considerable trade is carried on in coal, corn, timber, salt, iron, and slate, by means of the navigation of the Blackwater: there is a well-provided market on Friday, and a monthly fair for live-stock, especially for horses. Some linen is woven, and round the town are some bleach-greens, and potteries for coarse ware. Newtown-Stewart is in the barony of Strabane, on the left bank of the Strule (over which there is a bridge), 10 miles from Omagh, on the mail-road to Londonderry, and consists of several streets irregularly laid out, but well-paved: it had in 1831 a population of 1737. The houses are for the most part neat and well-built; and the town contains the parish church of Ardstraw, a Roman Catholic chapel, several Presbyterian or other dissenting meeting-houses, and the ruins of an antient castle. There is a market on Monday for agricultural produce and unbleached linen, and a monthly cattle-fair for live-stock. Stewartstown is in the barony of Dungannon, between Dungannon and Cookstown, and consists of a large market-place, and three streets meeting in it: it had in 1831 a population of 1010. Some linens and mixed fabrics of linen and cotton (called unions) are made; in the neighbourhood are several limestone-quarries, and considerable trade is carried on in the town, which is the mart of the surrounding district. Stewartstown contains a number of well-built houses of stone, slated, the parish church of Donaghenry, a Roman Catholic chapel, two Presbyterian meeting-houses, a school-house, and a market-house. The other market-towns are too small to require notice.

Of the post (not market) towns, Coal-island, in the barony of Dungannon, is the only one that calls for notice. It is three or four miles north-east of Dungannon, in the centre of the coal-field, and consists of a number of houses, generally of stone and slated, grouped near the basin in which the canal from the Blackwater terminates. Coal-island is surrounded by coal, gravel, sand, and clay pits; and in or near it are several potteries, bleach-mills, flour-mills, a manufactory of fire-bricks and crucibles, and two manufactories for spades and edge-tools; besides warehouses, granaries, and yards round the canal basin.

Divisions for Ecclesiastical and Legal Purposes.—This county contains the whole or part of 43 parishes, to which may be added 5 ecclesiastical districts, attached to churches or chapels, and making 48 ecclesiastical cures; of which 41 are rectories or vicarages, and the remaining 7 perpetual curacies. Of the 48 cures, 26, including all those in the barony of Dungannon, where the parishes are most numerous, and one or more in each of the other baronies, are in the diocese of Armagh; 16, including nearly all those in the barony of Strabane and above half of those in the barony of Omagh, are in the diocese of Derry; and 6, in the baronies of Clogher and Omagh, are in the diocese of Clogher: all these dioceses are in the ecclesiastical province of Armagh.

There were in the 48 parishes or ecclesiastical districts (including those parts of parishes which are in adjoining counties) in 1834, 53 churches or other places of worship of the establishment, besides school-houses or other places in which service was performed: there were at the same time 66 Roman Catholic chapels, besides several altars in the open air at which service was performed; and 63 meeting-houses for Presbyterians, and 26 for other Protestants (almost entirely for Wesleyan Methodists), besides school-houses and rooms in private houses, in which meetings for worship were held. (*First Report of Commissioners of Public Instruction, Parliamentary Papers for* 1835, vol. xxxiii.)

The number of day and Sunday schools, and of scholars on the books of the day-schools in these parishes, as far as returns could be obtained, was in 1834 as follows:—

	Schools.			Scholars on the books of
	Day.	Sunday.	Total.	Day-schools.
In 26 Parishes in the Diocese of Armagh	212	77	289	13,448
16 ,, ,, Derry .	173	82	255	11,180
6 ,, ,, Clogher	120	34	154	7,064
	505	193	698	31,692

(*Second Report of the Commissioners of Public Instruction, Parliamentary Papers for* 1835, vol. xxxiv.)

Tyrone is in the north-western circuit; the assizes are held at Omagh. Quarter-sessions for the baronies of Omagh and Strabane are held at the towns of Omagh and Strabane alternately: those for the baronies of Clogher and Dungannon are held at the towns of Clogher and Dungannon alternately. The county gaol is at Omagh.

The county constabulary force on the 1st January, 1841, consisted of 1 county-inspector (second-rate); 5 sub-inspectors (2 first-rate, 2 second-rate, 1 third-rate); 5 head-constables (second-rate); 24 constables; and 122 sub-constables (107 first-rate, 15 second-rate), with 7 horses. The total expense for the year 1840 was 7714*l*. 4*s*. 4¼*d*.

The county is included in the district of the Londonderry lunatic asylum. The county infirmary is at Omagh: there are fever-hospitals at Omagh and Strabane; and dispensaries at Ardstraw, Ballygawley, Benburb (between Moy and Caledon), Coagh (not far from Cookstown), Cookstown, Dromore, Drumquin, Dunnamanagh (not far from Strabane), Dungannon, Fintona, Gortin, Newtown Stewart, Omagh, Pomeroy (between Dungannon and Omagh), Same, Stewartstown, Strabane, Termonmaguirk, and Trillick. There is a dispensary for Clogher and Augher, and one for Castlederg and Killeter, but their locality is not given.

The grand-jury presentments for 1840 amounted to 48,312*l*. 14*s*. 8¾*d*., thus distributed:—

New roads, bridges, &c. . . .	£8,824	7	6
Repairing roads, bridges, &c. . .	17,536	16	2
Erection or repair of court or sessions houses	162	1	11
Erection or repair of gaols, &c. . .	50	0	0
All other prison expenses . . .	1,434	10	9
Salaries	715	4	7
Police	3,965	18	5
Salaries of county officers, not included above	4,170	18	9
Public charities	3,651	6	7
Repayment of advance to government .	5,115	7	0
Miscellaneous	2,686	2	10
	£48,312	14	8

Before the Union this county sent ten members to the Irish parliament, two for the county itself and two each for the boroughs of Dungannon, Strabane, Augher, and Clogher. It now sends three members to the imperial parliament, namely, two for the county, elected at Omagh and one for the borough of Dungannon. The county had in 1834-5, 1250 electors; in 1839-40, 3594: Dungannon had, in 1834-5, 197 electors; in 1839-40, 332.

History and Antiquities.—This county seems to have been included in the territory of the Darnii, a nation mentioned by Ptolemy. At a subsequent period, parts of it were known by the names of Hy-Briun and Hy-Fiachna (the latter being the country about the river Derg); and the whole appears to have been called Kinel Eoguin, or Tir-oen, modernized Tyrone. It was in the northern Hy-Niellis (or country of the O'Neills), which comprehended also a large part (if not the whole) of Donegal.

About A.D. 1177 the county was invaded by John de Courcy, one of the Anglo-Norman invaders; but appears to have remained in the hands of the O'Neills of Tir-oen, who were among the most powerful of the native chieftains. In the reign of Henry VIII. (A.D. 1542), Hugh O'Neill was created earl of Tyrone, with remainder to his illegitimate son Matthew, who was made lord of Dungannon. The earl, having formed a plan for revolting against the government, and for Matthew's exclusion, was, through the information of the latter, seized by Sir James Crofts, lord-deputy, and detained in prison in Dublin. His son Shane or John O'Neill, assembling some troops, partly Scottish adventurers, defeated the forces of the lord-deputy and of his brother Matthew, whom he afterwards assassinated: he then invaded the territory of Tir-Connell (now the county of Donegal), where he suffered a severe defeat, but contrived to maintain himself in his own district of Tyrone, of which, on the death of his father, he assumed the title of earl. He was assassinated (A.D. 1567) by a Scottish captain, in whose encampment he had taken refuge from the attack of Sir Henry Sidney, lord deputy. In the rebellion of Hugh O'Neill, earl of Tyrone, and son of Matthew of Dungannon (A.D. 1595 and following years), Dungannon Castle, where he resided, was burnt by him on the advance of the lord-deputy Sir William Russell. In 1597 the royal forces under Sir Henry Bagnal were entirely defeated at Benburb, on the banks of the Blackwater, on the border of the county. In A.D. 1601 O'Neill, pressed by the lord-deputy Mountjoy, was compelled again to burn Dungannon, and the erection of forts on the banks of the river Blackwater and on the shore of Lough Neagh compelled him to submit.

Tyrone had been formed into a county before this rebellion (A.D. 1584); but the first sheriff was not appointed until after its close (A.D. 1603). It was comprehended in the great settlement made in Ulster in the following years [ULSTER], and was, in great part, parcelled out among 'undertakers' (*i.e.* persons who undertook to form settlements or colonies), partly Scotch and partly English.

In the great rebellion of 1641 Dungannon Fort was seized by Sir Phelim O'Neill, and the whole county fell into the hands of the insurgents, except the forts of Augher and Castlederg, the garrisons of which repelled the attack. In 1646 the Scots and English under Monroe were defeated by the Irish insurgents at Benburb, with the loss of above 3000 men: this victory restored to the insurgents a predominance in Ulster, which however they finally lost on the arrival and success of Cromwell in 1649. In the revolutionary war, the army of James, after raising the siege of Londonderry, retired to Strabane in this county.

(*Ordnance Survey of Tyrone;* Lewis's *Topographical*

Dictionary of Ireland; Moore's and Leland's *Histories of Ireland;* Ware's *History and Antiquities of Ireland; Parliamentary Papers.*)

TYRRELL, JAMES, was the eldest of the four sons of Sir Timothy Tyrrell, of Shotover, near Oxford, by Elizabeth, only child of archbishop Usher; and was born in Great Queen-street, London, in May, 1642. After an elementary education in the free school of Camberwell, he was, in 1657, admitted a gentleman-commoner of Queen's College, Oxford, where he resided three years, and then entered himself of the Inner Temple. He took his degree of M.A. in September, 1663, and about two years after was called to the bar. He did not however follow the profession of the law, but employed a life of leisure in historical inquiries and the composition of his various works, residing at first on his estate at Oakley, near Brill, in Buckinghamshire, and afterwards at Shotover, for the sake of easier access to the Oxford libraries. He died in 1718, leaving by his wife Mary, daughter and heiress of Sir Michael Hutchinson, of Hadbury in Worcestershire, one son, lieutenant-general James Tyrrell, who was governor of Gravesend and Tilbury Fort, and afterwards of Berwick and Holy Island, and sat in parliament for Boroughbridge from 1722 till his death in August, 1742, at the age of 68.

Tyrrell's first appearance in print was in a dedication to Charles II. of a posthumous work of his grandfather archbishop Usher, entitled 'The Power communicated by God to the Prince, and the Obedience required of the Subject,' which had been drawn up, at the commencement of the civil war, by command of Charles I., and was now, in the beginning of the year 1661, published in quarto, by Dr. Sanderson, bishop of Lincoln. His next performance was an answer to Sir Robert Filmer's speculations upon government, in an octavo volume, printed at London in 1681, under the title of 'Patriarcha non Monarcha; or the Patriarch Unmonarched,' &c. This was followed by a defence of the conduct and character of Usher, published in 1686, at the end of Dr. Parr's life of the archbishop, as 'An Appendix to the Life of the Lord Primate Usher, containing a Vindication of his Opinions and Actions in reference to the Doctrine and Discipline of the Church of England, and his conformity thereunto, from the aspersions of Peter Heylin, D.D., in his pamphlet called *Respondet Petrus.*' Tyrrell, who with all the other deputy lieutenants and justices of peace of his county, had been struck out of the commission by James II. for refusing to dispense with the Test Act and other penal laws affecting the Roman Catholics, warmly hailed the Revolution; and, after the establishment of the new government, he came forth as a champion of that change in a series of 'Political Dialogues,' nine of which were published in quarto in 1692, a tenth in 1693, three more in 1694, another in 1695; and which were afterwards collected, and republished, in a folio volume, in 1718, and again in 1727, under the title of 'Bibliotheca Politica; or an Enquiry into the Antient Constitution of the English Government, with respect to the just Extent of the Regal Power and the Rights and Liberties of the Subject,' &c. In 1692 also he published anonymously, in octavo, 'A Brief Disquisition of the Law of Nature, according to the Principles and Method laid down in the Reverend Dr. Cumberland's (now Lord Bishop of Peterborough) Latin Treatise on that Subject.' It is mainly a translation and compendium of Bishop Cumberland's work 'De Legibus Naturæ,' not however without additional illustrations and other matter, and many changes in the arrangement and mode of exposition. But Tyrrell's great work is his 'General History of England, both Ecclesiastical and Civil,' in 3 vols. folio (commonly bound in five parts), Lond. 1700-1704. As expressed on the title-page, this history was intended to be brought down 'from the earliest accounts of time to the reign of....king William III;' but only a part of that design was accomplished: the first volume coming down to the Norman Conquest; the second, Part 1, to the accession of John; Part 2, to that of Edward I.; the third, Part 1, to the accession of Edward II.; Part 2, to the end of the reign of Richard II. It is asserted by Hearne, in his preface to Thomas de Elmham (8vo., Oxford, 1727), that a further portion of the work had been prepared for the press; but it has never appeared. Tyrrell's history, which has now become scarce, is valuable as being founded throughout upon the original chroniclers, of whose accounts indeed it is in great part a literal translation; but it is rather an undigested accumulation of materials than an historical narrative with even the humblest pretensions to an artistic character. Besides the narrative, there are many prefaces, introductions, appendices, &c., occupied with the investigation of particular points, or the defence of the author's favourite notions, the most remarkable of which are, that the Norman Conquest made scarcely any alteration in the original or Saxon frame of the government, and that the representation of the commons in parliament in particular has been uninterrupted since the Saxon times. The vindication of these opinions is also the object of several of his 'Political Dialogues.'

TYRRHE'NI. [ETRURIA.]

TYRTAEUS (Τυρταῖος), the second great elegiac poet among the antient Greeks. His age is determined by the fact that he assisted the Spartans in their second Messenian War, which is placed by Pausanias between the years B.C. 685 and 668, while others place its commencement about the year B.C. 660, and even later. The birth-place of Tyrtaeus is differently stated: Suidas calls him a Milesian or a Laconian: he of course became a Laconian after receiving the Spartan franchise; and the circumstance that after he was made a Spartan citizen he spoke in his poems of himself as such, and of his Spartan ancestors, led Strabo to think that Tyrtaeus was originally a Dorian of Erineos near Mount Pindus, from whence some centuries before a portion of the Dorians had immigrated into Peloponnesus. That he was actually residing in Attica, either at Aphidnae or at Athens, just before he went to Sparta, is attested by the general consent of antiquity. The common story about his going to Sparta, as related by Pausanias and others, runs thus. When the second Messenian War broke out, the Spartans, not knowing how to act, consulted the oracle of Delphi. The god commanded them to avail themselves of the advise of an Athenian, and an embassy was accordingly sent to Athens to ask for a man who was to be their adviser. The Athenians were unwilling to assist the Spartans in extending their dominion in Peloponnesus, and yet not wishing to disobey the command of Apollo, they sent to Sparta Tyrtaeus, a schoolmaster who was lame in one foot and had never shown any signs of talent. The story about his lameness may be questioned, but that his mental powers were anything but weak is sufficiently clear from the effects which his poetry is said to have produced at Sparta, and the remains which are still extant. The elegy, which had recently been introduced in Greece by Callinus of Miletus, was the means by which Tyrtaeus inspired the Spartans with courage and confidence, and by which he led them to their victories over the Messenians.

On his arrival in Sparta he recited his warlike anapaestic elegies to the magistrates and to as many of the people as he could gather around him, and he exhorted them in the most animating strains to fight bravely against their enemies. The number of such stirring war-songs (ὑποθῆκαι, or ὑποθῆκαι δὶ ἐλεγείας), which being sung to the accompaniment of the flute made a deep and lasting impression upon the Spartans, appears to have been very great. But the mission which Tyrtaeus had to fulfil was not only to breathe a new warlike spirit into the Spartans, but also to settle their internal dissensions; for those Spartans who had lost their lands in Messenia were discontented, and demanded a new division of land. For this purpose he composed the most celebrated of his elegies, called 'Eunomia' (Εὐνομία; Suidas calls it a πολιτεία), that is, 'good government.' Some fragments of it are still extant, and enable us to form some idea of the whole composition. A third class of elegies were march-songs, which the Greeks called μέλη πολεμιστήρια, ἐμβατήρια, ἐνόπλια, ἔπη ἀνάπαιστα, or προτρεπτικά. All the poems of Tyrtaeus had an extraordinary influence upon his hearers, but the most popular among them appear to have been his war-songs, for they continued for centuries after to be sung, not only at Sparta, but among the Dorians generally before they went out to battle. There are extant three entire poems of this kind, but it is a matter of great doubt whether they are not much mutilated and interpolated. All the works of Tyrtaeus were in later times collected and divided into five books.

Tyrtaeus had the good fortune to live to see the fruits of his wise advice—the reduction of the Messenians to the condition of Helots (Paus., iv., 14, 3); and the accounts which we now have of the second Messenian War are probably derived in a great measure from his poems. The first collection of the remains of Tyrtaeus that appeared in print is that of S. Gelenius and M. Aurigallus, which also contains the works of Callimachus, Basel, 1532, 4to. The edition of C. A. Klotz (‘Tyrtaei Opera quae supersunt omnia,’ &c., with a commentary and a German translation, Leipzig, 1767, 8vo.) is not worth much. The best editions in which the poems of Tyrtaeus are printed, together with those of Callinus, are those of J. V. Franke (‘Callinus, sive Quæstio de Origine Carminis Elegiaci: accedunt Tyrtaei Reliquiæ,’ &c., Altona, 1816, 8vo.), and N. Bach (‘Callini Ephesii, Tyrtaei Aphidnaei, Asii Samii Carminum quæ supersunt,’ Leipzig, 1831, 8vo). They are also contained in several collections of Greek poets.

(Thiersch, in the *Acta Philol. Monac.* of 1826, vol. iii., p. 587, &c.; and in general, Müller, *Hist. of the Lit. of Antient Greece*, i., p. 110, &c.; Bode, *Geschichte der Lyrischen Dichtkunst der Hellenen*, i., p. 211, &c.)

There are many versions of Tyrtaeus. The Elegies of Tyrtaeus were translated into English verse by R. Polwhele, 1786, 4to.; 1792, 8vo.; and the War Elegies (four) were imitated by J. Pye, 1795, 8vo.

TYRUS (צוֹר, צֹר, in Aramaean טְרָא, Τύρος), a city on the coast of Phoenicia, 200 stadia, according to Strabo, 24 miles, according to the Antonine Itinerary, south of Sidon. It is called in the Old Testament the ‘daughter of Sidon,’ and Justin states that it was a colony of Sidon. In process of time however Tyre exceeded the mother city in importance, and came to be the chief city of Phoenicia. [SIDON.] In the time of David and Solomon it was a very great commercial emporium, and was governed by a king (Hiram), who maintained friendly relations with those princes, and assisted Solomon in building the temple and his palaces, and in his naval expeditions. [OPHIR.] About half a century later Ahab married Jezebel, the daughter of the king of Tyre and Sidon (1 *Kings*, xvi. 31; Joseph., *Apion*, i. 18; *Antiq.*, viii. 13, 1). There seems to have been a constant commercial intercourse between the Tyrians and the Israelites. Tyre is repeatedly mentioned by the Hebrew prophets, who speak of its strength, wealth, beauty, and its flourishing commerce, and threaten it with destruction for its pride. Respecting the commerce and colonies of Tyre, see CARTHAGE; PHOENICIA; TARSHISH.

The original site of Tyre was on the mainland, but at some unknown period (probably before the time of Solomon; Joseph., *Antiq.*, viii. 2, 7) another city of the same name was built on a narrow island, about a mile in length, parallel to the shore, and nearly half a mile distant from it, and not quite four miles from the antient city. The latter was distinguished by the name of Old Tyre (ἡ πάλαι Τύρος, Παλαίτυρος, Vetus Tyrus), which it already bore in the time of Shalmaneser, the Assyrian conqueror, who took it: he also blockaded the insular city for five years, but was at last compelled to raise the siege (about B.C. 720-715). The insular city, which from its position soon eclipsed Old Tyre, was again besieged by Nebuchadnezzar for thirteen years. We are not told whether he took it, but certainly the prosperity of the city received a severe blow. It was taken, after a siege of seven months, by Alexander the Great (B.C. 332), who, in order to attack the city by land as well as by sea, connected the island with the mainland by a mole, which was formed chiefly out of the materials of Old Tyre, which was razed to the ground for the purpose. After the death of Alexander, Tyre came under the power of the Seleucidæ, and subsequently under that of the Romans. It was still a strong fortress, and (in the time of Strabo) a flourishing port. Sept. Severus sent thither a Roman colony, as his medals show. It afterwards became the seat of a Christian bishopric, and was, in the time of Jerome, the most beautiful city of Phoenicia. During the Crusades it suffered several sieges, and remained in the hands of the Christians much longer than any other city of Phoenicia. Its fortifications were almost entirely destroyed in those wars, and now it is only a small village.

The island on which it stands has been a peninsula ever since the construction of the mole by Alexander. The ruins of Tyre (now called Sur) are minutely described by Robinson (*Biblical Researches in Palestine*, iii. 392, &c.)

TYRWHITT, THOMAS, was the eldest son of the Rev. Dr. Robert Tyrwhitt, the descendant of an antient Lincolnshire family, who at the time of the birth of his son, in London, 29th March, 1730, was rector of St. James's, Westminster, and afterwards became a canon residentiary and prebendary of St. Paul's, archdeacon of London, and a canon of Windsor. Thomas was first sent to school at Kensington, whence he removed in 1741 to Eton, and he remained there till he was entered of Queen's College, Oxford, in 1747. In 1755 he was elected to a fellowship of Merton College; and, having taken his degree of M.A. the following year, although he had also entered himself of the Middle Temple, he continued his residence at the university till 1762, when, resigning his fellowship, he came up to London, and entered upon the duties of the office of clerk of the House of Commons, to which he was appointed on the resignation of Jeremiah Dyson, Esq.; but finding the fatigue too great for his health, he relinquished this appointment in 1768, and devoted the rest of his life to literary pursuits. Mr. Tyrwhitt, who was greatly beloved for his amiable character, died at his house in Welbeck-street on the 15th of August, 1786.

The following is a list of his publications, all of which display sound scholarship, extensive reading, and eminent taste and critical acumen, or, at the least, great accuracy and precision, and the most painstaking and conscientious industry, where higher qualifications were not called for:—A poem, entitled ‘An Epistle to Florio at Oxford’ (Mr. Ellis of Christ Church), 4to. Lond. 1749. ‘Translations in Verse’ of Pope's ‘Messiah’ and Philips's ‘Splendid Shilling’ into Latin, and of the ‘Eighth Isthmian Ode’ of Pindar into English, 4to., 1752. ‘Observations and Conjectures on some Passages in Shakspeare’ (anonymous, but with the portrait of the author prefixed), 8vo., 1766. ‘Proceedings and Debates in the House of Commons in 1620 and 1621, from the original MS. in the Library of Queen's College, Oxford, with an Appendix,’ 2 vols. 8vo., Clarendon Press, 1766. ‘The Manner of Holding Parliaments in England; by Henry Elsynge, Cler. Par.; corrected and enlarged from the Author's original MS.,’ 8vo., 1768. ‘Fragmenta Duo Plutarchi’ (from the Harleian MS. 5612), anonymous, 8vo., 1773. ‘The Canterbury Tales of Chaucer,’ with Dissertations, Notes, Glossary, &c., 2 vols. 4to., Oxford, 1775; also 5 vols. 8vo., 1778; and since several times reprinted. This is in all respects an admirably edited work. ‘Dissertatio de Babrio, Fabularum Aesopicarum Scriptore,’ 8vo., 1776. ‘Poems supposed to have been written at Bristol, in the Tenth Century, by Rowley and others, with a Preface, &c. (in refutation of the alleged antiquity of the poems),’ 8vo., 1778. ‘A Vindication of the Appendix to the Poems called Rowley's,’ 8vo., 1779. An edition, in Greek and Latin, with notes, of the poem entitled Περὶ Λιθῶν (On Stones), attributed by some to Orpheus (but according to Tyrwhitt written in the early part of the fourth century). ‘Conjecturæ in Strabonem’ (privately printed), 1783. An edition of an ‘Oration of Isaeus against Menecles,’ newly discovered in the Medicean Library, 1785. He also left materials for a new edition of Aristotle's ‘Poetics,’ which were prepared for the press by the Rev. Thomas Burgess and the Rev. John Randolph (afterwards bishops of Salisbury and London), and brought out at the Clarendon Press, in quarto and also in octavo, in 1794. Tyrwhitt is the author of the best notes in Dr. Musgrave's edition of ‘Euripides,’ 1778, and of many of the most valuable in the variorum editions of Shakspere; and he has enriched the ‘Transactions’ of the Society of Antiquaries (the ‘Archælogia’) with several disquisitions of distinguished learning and ingenuity. His ‘Dissertation on Babrius,’ after having been republished by himself with additions at the end of his edition of the Greek poem ‘On Stones,’ was reprinted at Erlangen in Bavaria; and so were his ‘Conjectures upon Strabo,’ in 1788, under the superintendence of Th. Ch. Harles. An octavo volume, entitled ‘Thomæ Tyrwhitti Conjecturæ in Æschylum, Euripidem, et Aristophanem: accedunt Epistolæ Diversorum ad Tyrwhittum,’ was brought out at Oxford, from the Clarendon Press, in 1822; and it appears from the preface that a small impression of the same matter had many years before been printed, under the care of Burgess, at Durham. The letters, which fill from p. 91 to p. 164, are from Valcknaer (in Latin), from Villoison (in French), from Brunck (in French), from Ruhnken (in Latin), from Schweighäuser (in Latin and French), and from Ch. Fred. Matthaei of Moscow (in Latin). The editors promise another volume, to consist of Adversaria collected from Tyrwhitt's papers; but this, we believe, has not yet appeared.

TYSON, EDWARD, was born in Somersetshire in 1649. He studied at Oxford, and received his bachelor's degree there in 1670, after which he went to Cambridge, where he was made doctor of medicine in 1680. He lived in London, and was physician to the Bridewell and Bethlem hospitals, reader of anatomy at Surgeons' Hall, and, for a time, Gresham professor of medicine. He was one of the chief contributors to the early volumes of the Transactions of the Royal Society, of which, as well as of the College of Physicians, he was a Fellow. He died in 1708.

Tyson was one of the first comparative anatomists of his time. All his works are distinguished by great accuracy and depth of research; they are to this day of unquestioned authority in matters of fact; and they prove that he thoroughly understood the scientific purpose of comparative anatomy. The chief of them are as follows:—1, 'Phocæna, or the Anatomy of a Porpesse dissected at Gresham College,' London, 1680, 4to.; 2, 'Carigueya, seu Marsupiale Americanum; or the Anatomy of an Opossum dissected at Gresham College,' London, 1698, 4to.; 3, 'Orang-Outang, sive Homo Sylvestris; or the Anatomy of a Pygmie, compared with that of a Monkey, an Ape, and a Man,' London, 1699, folio. This is Tyson's best and most valuable work; for though the others are not less accurate, this relates to an animal for the dissection of which opportunities are exceedingly rare. It was a chimpanzee, and the later labours of Professors Owen and Vrolik, though they have added to what Tyson described, have proved the complete accuracy of nearly all his observations; an accuracy the more meritorious, because, before his time, no dissection of the animal had been recorded. Haller, with full justice, says, 'We have nothing in comparative anatomy that can be compared to this work, excepting the works on insects;' by which last he probably means those of Swammerdam. 4, There was published with the last-mentioned work, 'A Philological Essay concerning the Pygmies, the Cynocephali, the Satyrs, and Sphinges of the Ancients, wherein it will appear that they were all either Apes or Monkeys.' 5, And to a second edition of the two preceding was added, 'Vipera Caudisona Americana, or the Anatomy of a Rattle-Snake.' 6, 'Several Anatomical Observations,' London and Oxford, 1680-1705, folio.

Some of these works had before appeared in the 'Philosophical Transactions,' which contain numerous other papers communicated by Tyson between 1678 and 1704. The most important among them relate to the renal capsules, the anal glands of the musk-animal and others, the black excretion of the cuttle-fish, the anatomy of the entozoa and of the Tajassu, and the growth of hair and teeth in ovarian cysts. Tyson also contributed largely to Samuel Collins's 'System of Anatomy,' to Ray's 'Synopsis Methodica Quadrupedum,' and to Willughby's 'Historia Piscium.'

(*Dictionnaire Historique de la Médecine*; Haller, *Bibliotheca Anatomica*, t. i., 656.)

TYSSENS, PETER, a celebrated Flemish painter, born at Antwerp, in 1625. Tyssens, after Rubens and Vandyck, was the first Flemish painter of his time, in history and in portrait. He first practised as an historical painter and was highly patronised, but finding portrait painting a more profitable employment, he devoted his time exclusively to that branch of the art, until, disgusted with some uncandid criticisms which were passed upon some of them, he gave up portrait painting, and again applied himself, with increased success, to history. There are few cities in Flanders without a specimen of the works of Tyssens, but there are few of his paintings out of his own country. The Assumption of the Virgin, over the great altar of the church of St. James at Antwerp, is generally considered his masterpiece. His drawing was vigorous and correct, his colouring good, and his composition very spirited: he enriched his pictures by tasteful architectural backgrounds. In 1661 Tyssens was made director of the Academy of Antwerp. He died in 1692.

His two sons, NICHOLAS and AUGUSTINE, were also distinguished painters in their respective lines. Nicholas Tyssens was born at Antwerp in 1660; spent several years in Italy, and in 1770 was employed in the service of John William, the elector-palatine at Düsseldorf, who sent him to the principal cities of the Netherlands to purchase pictures for the gallery which he was about to form there. Tyssens executed his commission to the utmost satisfaction of the elector, but the pictures which he purchased, with others of the Düsseldorf gallery, now form part of the collection of the Pinakothek at Munich. Tysseus first painted armour, implements of war, and trophies: he afterwards tried flower-painting, but he painted latterly birds, in which he was very excellent; and his pictures of this class are little inferior to those of Boel or Hondekoeter. He visited London, where he is said to have died in 1719.

Augustine Tyssens was born at Antwerp in 1662, and was a landscape painter, and executed many clever pictures in the style of Berghem, which he enriched in a similar way, with ruins, figures, and cattle. In 1691 he was made director of the Academy of Antwerp. He died in 1722.

(Descamps, *La Vie des Peintres Flamands, &c.*; Pilkington, *Dictionary of Painters*, ed. 1829.)

TYTLER, WILLIAM, was born at Edinburgh, 12th October, 1711. His father was Mr. Alexander Tytler, writer (or attorney) in Edinburgh; his mother, Jane, daughter of Mr. William Leslie, merchant in Aberdeen. He himself, after an education at the high school and University of Edinburgh, was admitted a writer to the signet in 1742; and he practised that branch of the legal profession till his death, Sept. 12th, 1792. Mr. Tytler, besides being an accomplished musician, and distinguished for his taste in all the fine arts, was the author of several literary works, the chief of which, his 'Inquiry, Historical and Critical, into the Evidence against Mary Queen of Scots,' first printed in an 8vo. vol., in 1759, and, after several editions, extended to 2 vols. 8vo., in 1790, acquired him considerable reputation. It is a defence of Mary, principally against Robertson and Hume. His other publications are:—'A Dissertation on the Marriage of Queen Mary to the Earl of Bothwell,' in the 'Transactions of the Society of Antiquaries of Scotland,' vol. i., 4to., 1791; 'The Poetical Remains of James I. of Scotland,' 8vo., Edin., 1783; 'A Dissertation on Scottish Music,' subjoined to Arnott's 'History of Edinburgh;' 'Observations on the Vision,' a poem, first printed in Ramsay's 'Evergreen;' and an essay 'On the Fashionable Amusements of Edinburgh during the last Century,' both published in the Scottish 'Antiquarian Transactions;' and one paper in the 'Lounger.' Mr. William Tytler was the father of Alexander F. Tytler, Lord Woodhouselee.

TYTLER, ALEXANDER FRASER, styled Lord Woodhouselee, was born at Edinburgh, 15th October, 1747, and was the eldest son of William Tytler, Esq., of Woodhouselee, in Midlothian, and of Anne Craig, daughter of James Craig, Esq., of Costerton, in the same county. He attended the high school of his native town from 1755 to 1763, when he was sent to an academy kept at Kensington, in Middlesex, by James Elphinstone, the author of many works on English grammar and pronunciation. Here he studied drawing, natural history, and Italian, as well as the classics. Returning home in 1765, he entered the University of Edinburgh with a view of studying for the bar. He was admitted an advocate in 1770, and in 1776 married Anne, eldest daughter of William Fraser, Esq., of Balnain, which property, as well as his paternal estate, he eventually inherited. His practice, like that of most young advocates, left him leisure enough for some years; the first fruits of which he gave to the world, in 1778, by the publication of a supplementary (folio) volume to Lord Kames's 'Dictionary of Decisions,' bringing down the work to that date. This compilation was undertaken on the suggestion of Kames, who showed the author much friendship, and aided his labours by his counsel and revision. In 1780 Tytler was conjoined with John Pringle, Esq., who had occupied the chair for some years, in the professorship of universal history and Roman antiquities in the University of Edinburgh; and in 1786 he became sole professor, on the resignation, we believe, of his colleague. This appointment led to the publication, in 1782, of his 'Outlines of a Course of Lectures,' afterwards expanded into 'Elements of General History,' 2 vols. 8vo., Edinburgh, 1801, a work which has been repeatedly reprinted, the latest edition being that revised and continued to the death of William IV. by the Rev. Edward Nares, D.D, regius professor of modern history in the University of Oxford, in 1 vol. 8vo., Lond., 1840. The lectures, of which this work is an abstract, were left ready for the press by the author, but have never been published. In 1790 Mr. Tytler was promoted to the office of judge-admiral of Scotland; and the same year he read before the Royal Society of Edinburgh, of which he had been a member and one of the secretaries since its institution in 1783, a series of papers, which he soon after published anonymously, under the title of 'An Essay on the Principles of Translation.' This performance met with a very welcome reception from the public, and has gone through many editions. A memoir of Dr. John Gregory, prefixed to a collected edition of his works published by his son, the late Dr. James Gregory, in 1478; four papers contributed to the Edinburgh periodical publication entitled the 'Mirror,' in 1779; seven contributed to its successor, the 'Lounger,' in 1785; various essays in the 'Transactions' of the Edinburgh Royal Society; a 'Treatise upon Martial Law;' a new edition of Derham's 'Physico-Theology,' with notes, &c., and a Life of the author, published in 1799; and a letter published the same year at Dublin, under the title of 'Ireland profiting by Example; or the Question considered, whether Scotland has gained or lost by the Union,' are the other principal literary productions of this period of his life. In 1802 he was raised to the bench of the Court of Session, when he took the title of Lord Woodhouselee, from the property of which he had come into possession on the death of his father ten years before. In 1807 he published his last work, 'Memoirs of the Life and Writings of Henry Home, Lord Kames,' 2 vols. 4to., Edinb. This work (of which there is also an edition in 4 vols. 8vo.) has never excited much attention. In 1811 Lord Woodhouselee was appointed a lord of justiciary; but his health, which had some years before been broken by a severe illness from which he never perfectly recovered, soon after this gave way, and his death took place on the 4th of January, 1813. A memoir of this respectable writer and excellent man (from which these facts have been taken) was read by his friend, the late Rev. Archibald Alison, before the Royal Society of Edinburgh, on the 3rd of June, 1816, and 6th of January, 1817, and is printed in the Society's 'Transactions,' vol. viii., 4to., Edinburgh, 1818, pp. 515-564.

TZANA, LAKE. [Abyssinia; Nile.]

TZETZES, JOANNES, a learned grammarian and poet of Constantinople, who lived during the latter half of the twelfth century of our æra. He was a son of Michael Tzetzes and Eudocia: his father's brother, Joannes Tzetzes, though himself an unlettered man, was fond of the society of the learned. His father was descended from a Basque or Iberian family, but his mother was of a Greek family. He had a brother Isaac, with whom Joannes spent the first years of his life in his father's house, where, as Joannes says, they were trained in all virtue and piety, and learned to despise the wealth and honours of the world. The two brothers were instructed by the ablest teachers of the time, and were afterwards distinguished by the title of grammarians, which then designated a learned and accomplished scholar. Further particulars of their lives are not known.

We possess a considerable number of works by Joannes Tzetzes, consisting of poetical compositions, or rather versified prose, commentaries on antient Greek authors, and some minor works of a scientific character. His poetical works, most of which are written in the so-called political verse, that is, without any regard to prosody, but in a metre in which only the syllables are counted, are:—1, 'Iliaca' (Ἰλιακά), which, properly speaking, consists of three distinct poems, which are called 'Ante-Homerica,' 'Homerica,' and 'Post-Homerica.'. The first contains the whole cycle of the Trojan story from the birth of Paris to the tenth year of the siege of Troy, where the 'Iliad' begins; the second is a mere abridgment of the 'Iliad;' and the third contains the events subsequent to the death of Hector, and an account of the return of the Greeks from Troy. The whole is, like all the versified productions of Joannes Tzetzes, exceedingly dull. Some fragments of this work were first published by F. Morel, who did not know the author's name, in his 'Iliacum Carmen Poetae Graeci cuius nomen ignoratur,' and by Dodwell, in his 'Dissertationes de Veterib. Graec. et Rom. Cyclis,' p. 802. In the year 1770 G. B. von Schirach published, from an Augsburg MS., nearly the whole of the 'Ante-Homerica,' a portion of the 'Homerica,' and Dodwell's fragment of the 'Post-Homerica.' T. C. Tychsen at last discovered in a Vienna MS. the complete 'Ante-Homerica' and 'Post-Homerica,' and communicated his copy of them to Fr. Jacobs, who, after having also procured a complete copy of the 'Homerica,' published the first complete edition of this work at Leipzig, in 1793, 8vo. The best critical edition of the text, for which a Paris MS. was collated, is that by Imm. Bekker, Berlin, 1816, 8vo. 2, Βίβλος ἱστορική, more commonly called 'Chiliades,' or 'Chiliades Variarum Historiarum.' The former is the name which Tzetzes himself gives to this work; the latter arose from the circumstance that the first editor, N. Gerbelius, divided the whole work into sections of 1000 verses each. Tzetzes himself had divided it into three tables (πίνακες), the first of which contained 140 stories, and ended at Chil. iv. 466. Between the first and second table there is a letter addressed to one Joannes Lachanes, and the second begins at Chil. iv. 781, extending to Chil. v. 192, and contains 32 tales. The third, comprising the remainder of the work, contains 496 narratives. This work, with its numerous mythical and historical tales, is a storehouse of information, and innumerable things are recorded here which would otherwise be unknown. It is however highly probable that Tzetzes did not always derive his information from the original sources, and that he compiled it from the works of other grammarians and scholiasts. The author is exceedingly vain: he is full of his own praise and of that of his brother; he delights in mentioning his own name on all occasions, and he treats all other writers with contempt. The first edition of the 'Chiliades' is that of N. Gerbelius, with a Latin translation by P. Lacisius, Basel, 1546, fol. The best edition is that by Kiessling, Leipzig, 1826, 8vo. 3, 'Carmen Iambicum de Filiorum Educatione,' or 'On the Education of Children.' This poem is usually added in the editions of the 'Chiliades.' 4, A fragment of a poem, called Περὶ Ῥημάτων Ἀνθυποτάκτων, is printed in Bekker's 'Anecdota,' iii., p. 1090. Several other versified productions have never been published, but exist in MS. in various libraries. The most remarkable among them is a ὑπόθεσις τοῦ Ὁμήρου, consisting of upwards of 8000 so-called political verses, and giving explanations of the mythuses which occur in the 'Iliad.'

Joannes Tzetzes wrote commentaries, but only those on the 'Iliad,' on Hesiod, and on Lycophron have been printed. Others, as those on Oppian's 'Halieutica,' on the canon of Ptolemaeus, as well as his original works 'On Comedy and Comic Poets,' the 'Abridgment of the Rhetoric of Hermogenes,' a collection of his letters, and other works, are still in MS. The only edition of the 'Commentary on the Iliad' ('Exegesis in Homeri Iliadem') is that by G. Hermann, who published it with the work of Draco of Stratonicea on metres, Leipzig, 1812, 8vo. The commentary on Hesiod is printed in the editions of this poet, by Victor Trincavelli, Venice, 1537, 4to., and in that of Daniel Heinsius, Leyden, 1603, 4to. The commentary on Lycophron's 'Cassandra' is ascribed in the MS. to Isaac Tzetzes, the brother of Joannes, but Joannes states in two passages ('Chil.' ix. *Hist.* 296; *Epist. ad Basil. Achridenum*, printed in Potter's 'Commentary on Lycophron,' p. 111 that he wrote the commentary himself and gave it to his brother Isaac. J. C. Müller, the last editor, is of opinion that it is the joint production of the two brothers; that Isaac first published it, and that Joannes afterwards made an improved and enlarged edition. This opinion is strongly supported by the condition of the existing MSS., some of which contain considerably more matter than others, and display all the vanity and arrogance which are so striking in the 'Chiliades.' But however this may be, the commentary is a most useful compilation from those of the Alexandrine grammarians, and contains a vast amount of mythological and historical information not to be obtained elsewhere, and without it we should scarcely be able to understand the obscure poem of Lycophron. It is printed in several editions of Lycophron, first in that of Basel, 1546, fol., and subsequently in those of Canter, Potter, and Sebastiani. The last and most correct edition, without the text of Lycophron, is that by C. G. Müller, Leipzig, 1811, 3 vols. 8vo., with useful notes and indices.

TZETZES. ISAAC. [Tzetzes, Joannes.]

TIGRIS. The northern shore of the Persian Gulf extends from 48° E. long. (Greenwich) to 50° 9′, nearly in a straight line from east to west, nowhere falling more than six geographical miles short of the thirtieth parallel of north latitude, and nowhere exceeding that parallel by more than twelve such miles. Along this line, between the point on which Manama tower stands (29° 55′ N. lat., 48° 27′ E. long.)* and Ras Tuloop (30° 12′ N. lat., 49° 15′

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* In this paper the positions of many places are expressed by simply stating their longitude and latitude. The necessity of condensation has rendered this unavoidable; but it must be kept in mind that throughout the greater part of the basin of the Tigris and Euphrates the latitudes and longitudes can only be considered as approximative The position of the mouths of the rivers having been fixed by the survey of the East India Company's officers in 1824-5-6, may be considered as closely approaching to accuracy. The positions on the Tigris and Euphrates, from the sea to Mosul on the former river, and to Somechal on

E. long.) the united waters of the Euphrates, Tigris, Kerkhah, Karun, and Jerahi, enter the sea. The manner in which the streams of these rivers unite and again diverge in the great plain north of the Persian Gulf, has appeared to render it adviseable, instead of describing each separately, to present them in the light of channels of one great drainage basin. The watershed of this basin extends from Ras Tuloop nearly north-east to the source of the Jerahi (about 31° 30′ N. lat., 50° 30′ E. long.); thence in a direction somewhat to the west of north to the sources of the Kerkhah in Mount Elwend (about 34° 40′ N. lat., 48° 40′ E. long.); thence to the source of the Diyalah (about 30° 40′ N. lat., 47° 30′ E. long.), which joins the Tigris below Bagdad; thence to the sources of the Lesser Zab (near 37° N. lat. and about 45° 30′ E. long.), also an affluent of the Tigris; thence to the eastern source of the Great Zab (about 38° N. lat., 44° E. long.); thence to the source of the eastern branch of the Euphrates (about 39° 20′ N. lat., 43° 30′ E. long.); thence in a direction rather to the north of west to the sources of the western branch of the Euphrates (about 40° N. lat., 41½° E. long.); thence in a direction south of east to the sources of the Tokhmah-su (about 39° N. lat., 36½ E. long.); and thence by a line, none of the points of which have been well ascertained, which passes to the east of Aleppo and Damascus at an uncertain distance from the west bank of the Euphrates, to the west shore of the Persian Gulf. Looking back upon the watershed, the most important points of which have been here indicated, it will be seen that the largest diameter of the drainage-basin of the Tigris and Euphrates extends from about 30° N. lat. and 49° E. long. to about 40° N. lat. and 41½° E. long.; that it is narrowest at its southern and depressed extremity, where it only extends from about 48° E. long. to 49½° E. long., and broadest near its northern and elevated extremity, where it extends from about 36½° E. long. to about 43½° E. long. It must be observed however that in this outline has been included a portion of a mountainous district, which, strictly speaking, cannot be said to belong to the drainage-basin of the Tigris and Euphrates. There is a mountain-group extending from 42° E. long. to near 44° E. long., and from near 38° N. lat. to 39° N. lat., in a central depression of which Lake Van is situated. The streams which unite to form the greater Zab and the Eastern Tigris have their sources on the southern declivity of this group; the sources of the Eastern Euphrates are on its northern declivity; but the great body of water collected in the interior of this mountain-group has no apparent outlet; it is a lofty promontory projecting into the drainage-basin of the Tigris and Euphrates, but, hydrographically, entirely unconnected with it.

The statistics and political history of this region have been treated under the heads of the Persian and Turkish empires; at present it is only their physical and comparative geography that is to be considered.

Within the basin of the Tigris and Euphrates a great plain extends in a north-east direction from the sea, from 30° N. lat., to a short way beyond the parallel of Bagdad, or to nearly 33½° N. lat. The maximum width of this plain, about midway between Bagdad and the sea, appears to be about 150 miles. Over all this space its average elevation nowhere appears to be more than 200 feet above the level of the sea. To the north-east of this central plain is the declivity of the high table-land of Persia; to the north-west the declivity of the high table-land of Armenia and Asia Minor; to the south-west the declivity of the great Syrian desert and the northern districts of Arabia. The physical geography of the whole region will be most satisfactorily described by—First, tracing in succession the principal rivers which furrow the north-west and north-east sides of the basins, from their sources to their entry into the plain; secondly, indicating, as well as the existing materials admit, the conformation and appearance of the riverless south-east side; thirdly, by sketching the central plain with the river channels which intersect it.

I. The principal rivers which descend the north-west and north-east sides of the basin are—1, the Euphrates and its affluents; 2, the Tigris, and those affluents which join it before it enters the plain; 3, the Diyalah and its affluents; 4, the Kerkhah and its affluents; 5, the Karun and its affluents; 6, the Jerahi and its affluents.

The Euphrates.—The main trunk of this river is formed about two hours above Kebban Maden (39° N. lat., 39° E. long.) by the confluence of two rivers, to both of which the name Frat is occasionally applied, but which are more generally known, the eastern as the Murad-chai, the western as the Kara-su.

The Murad-chai rises on the west side of Ala-tag, near the north-east termination of the mountain-group mentioned above as encircling lake Van. The stream flows down a mountain ravine nearly six hours due north to Diyadin (39° 32′ N. lat., 43° 40′ E. long.); at Diyadin it turns to the north-west, and flows in that direction about 24 miles to Kara-Kilisa. In this part of its course the Murad-chai has the undulating country at the base of Ala-tag on its left bank, and a high undulating land which connects the mountain-range, of which that summit forms a part, with a chain of hills extending from the north-west base of the greater Ararat (39° 42′ N. lat., 44° 18′ E. long.) westwards along the south bank of the Aras. At Kara-Kilisa the Murad-chai receives the Sheriyan-su, which rises in these hills and flows from west to east; the united waters flow to the south-west. From Diyadin to Molla-Suleiman near the source of the Sheriyan-su is a distance of nearly 40 miles in a straight line: the level land on both sides of the streams varies in breadth from 6 to 16 miles; it is called the plain of Arishkerd. The soil is rich and watered on the north by numerous streams flowing to the Murad-chai, which runs in a ravine considerably below the level of the plain. Nine miles below Diyadin the Murad-chai, in the month of September, 1838, was 20 or 30 paces in breadth, and did not reach above a horse's knee. The height of the plain of Arishkerd is only conjecturally known; it cannot be less than 6000 feet above the sea, and is probably more. From Kara-Kilisa to the junction of the Char-buhur with the Murad-chai (about 39° N. lat., 41° 30′ E. long.) scarcely anything is known of the course of the latter. It appears to flow in a general direction of south-west, having the mountain-range of which Ala-tag, Sapan-tag (about 10,000 feet), and Nimrud-tag are the most remarkable summits, stretching parallel to it at a considerable distance on the south-east, and the mountains south of the Aras and of Erzrum at about an equal distance to the north-west. The town of Malasgird is situated on the Murad-chai about 36 miles below Kara-Kilisa; not far from Malasgird the Kaleh-su joins the Murad-chai from the north-west. Near the source of the Kaleh-su is Khinis, which the natives say is 24 miles from Malasgird. Captain Glascott's barometrical measurement gives Khinis an elevation of 5686 feet above the sea; and Mr. Brant was informed at Kara-Kilisa, that from the opposite base of the low hills bounding the plain of Arishkerd on the south-west to Khinis was a continuous plain. The Char-buhur rises near the sources of the Aras in a continuation of the mountain district extending west from Ararat, and flows 36 or 40 miles till it joins the Murad-chai: the rivers meet in a straight line, the former coming from the west, the latter from the east, and the surface of the water at the point of junction was about 70 yards wide in the month of June, and, measured by the barometer, it appeared to be 4138 feet above the sea. The united stream turns off at right angles to the south, through a narrow valley which widens gradually till it becomes part of the plain of Mush. The river retains the direction of south for about 10 miles, when it receives the Kara-su, flowing from the south-west declivity of the Nimrud-tag, and again turns to the west. The course of the Murad-chai from a few miles below its junction with the Kara-su to Palu (38° 43′ N. lat., 39° 58′ E. long.), is not much better known than its course between Kara-Kilisa and the mouth of the Char-buhur. From the sources of the Kara-su in the Nimrud-tag (about 42° E. long.) to the western extremity of the plain of Alishan (about 39° E. long.) appears to be one continuous valley. On the north side of this valley is a mountain-range connected with that which extends west from Ararat between the upper Aras and upper Murad-chai, and which between

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the latter, resulting from the operations of the expedition under Colonel Chesney, and the measurements of Lieuts. Murphy and Lynch, may be relied upon with still greater confidence. The intermediate positions in Mesopotamia, even when received from less trustworthy observers, being checked by these, are entitled to a considerable degree of confidence. The only other point which can be regarded as fixed with equal precision is Mount Ararat (a little beyond the extreme north-east point of the basin of the Tigris and Euphrates). Our knowledge of all the rest of this region is derived from routes of casual passengers, and more or less isolated astronomical observations, made in haste and sometimes by incompetent observers. The Russian military survey extending to Erzrum, and the survey executed by Colonel Monteith in Azerbijan, have afforded points of departure with which several important routes in the north and east parts of the basin have been connected; but both of these, although respectable operations, are less to be relied upon than those of Lieutenant Murphy and his associates.

Erzrum and Mush is called Bingol-tag: between Erzingan and Palu it is called Dujik-tag. The summits of the Bingol-tag retain patches of snow throughout the summer; the snow melts entirely from the Dujik-tag in summer, but the road which crosses it from Palu to Erzrum is blocked up with snow three months of the year. On the south side of the valley is a mountain-range, on the opposite or southern declivity of which are the sources of the Tigris. The direction of this chain is nearly east and west; about 30 miles east of Mush it touches the extremity of the Nimrud-tag (the direction of which is about south-west to north-east, and continues onward along the southern shore of lake Van to near the west shore of lake Urumiyah (about 45° E. long.). This chain was crossed by Mr. Brant, near where it abuts upon the Nimrud-tag, between Mush and Bitlis, at an elevation of at least 5500 feet; to the west of Mush, at an elevation of 6799 feet; and between Arghana Maden and Kharput (49½° E. long.), at an elevation of 4864 feet. The mountain-peaks of course exceed in height the crests of the passes, but none of them appear to retain snow during the summer. The Murad-chai enters the plain between these ranges from the north, near its junction with the Kara-su (41½° E. long.), and flows west between them till it receives the river of Alishan (39½° E. long.), at which point it turns to the north-west and flows through a precipitous ravine to Kebban Maden. The eastern extremity of this valley (from the sources of the Kara-su to a ford on the Murad-chai, a few miles below their junction), and its western extremity (from Palu to the sources of the river Alishan), alone are known in detail. Mr. Brant's route between these points passed along the declivity of the northern mountains at a considerable distance from the river. The Murad-chai at its junction with the Kara-su is about 4000 feet above the level of the sea; at Palu it is 2820 feet. A few miles below its junction with the Kara-su it was forded in the month of August, where it is divided into two channels. The northern channel was only knee-deep, in the southern the water reached to the horse's shoulders; a little earlier in the season it could not have been forded: where the channels re-united the river was 100 or 120 yards broad; the current was slow. At Palu the river in the month of July was 100 yards wide and the current very rapid: there is a ford opposite the town, but intricate and precarious. Above Palu the stream is narrowed by mountains rising abruptly from its banks in some places to a breadth of 33 yards. Between Mush and Palu the river is navigated (down stream) by rafts supported on inflated skins, which are employed in transporting charcoal, firewood, &c. Between the mouth of the Alishan river and Kebban Maden the banks of the Murad-chai do not appear to have been visited by Europeans.

The Kara-su, or Western Euphrates, rises, according to Mr. Abbott, at Domlu, seven and a half hours north-north-east of Erzrum. Two hours below Domlu the stream enters the plain of Erzrum, through which it flows from east to west for about 40 miles: it there receives a torrent flowing from Kara-Kulak to the east, and the united stream turning to the south descends through a ravine into the plain of Terjan. The length of the plain of Erzrum from its eastern termination a few miles east of the city of that name, to the sources near Kara-Kulak is about twenty-six hours, or about 65 miles: its greatest breadth is from 15 to 20 miles. The house of the British consulate at Erzrum is, according to the observations of Mr. Glascott, 39° 55′ N. lat.; the observations of the Russian imperial staff place the town in 41° 18′ E. long. The mean of sixty observations with the barometer, in April, 1838, gave it an elevation of 6114 feet above the sea. The south boundary of the plain of Erzrum is formed by the mountains already noticed under the names Bingol-tag and Dujik-tag; the northern boundary by a range of highlands which appears to extend uninterrupted from beyond Kars on the east to the south of Kaisariyeh at the foot of Mount Argaeus, dividing the valley of the Euphrates from the rivers which flow into the Black Sea. The eastern termination of the plain of Erzrum appears to be formed by an interlacing of the swelling grounds at the bases of these opposite ranges separating the valley of the Aras from the valley of the Kara-su, in a manner analogous to that in which the upper waters of the Murad-chai are separated by a similar inconsiderable range of heights from the valley of the Alsas, an affluent of the Aras, which flows between Bayazid and Ararat. The west termination of the plain of Erzrum is formed by the meeting of projecting spurs of the north and south mountain-ranges; of the spur of the Dujik-tag, which bounds the valley of the Mama-Khatun on the north, and the spur of the opposite range, which forms the south side of the stream coming from Kara-Kulak. At the point where the river quits the plain of Erzrum it was about 100 yards broad in the month of October, 1838. The plain of Terjan, at the lower end of the ravine by which the Kara-su escapes from the plain of Erzrum, must lie considerably lower, for the winter is not severe enough to prevent the cattle being sent out to feed, and the grain turns yellow in Terjan before the heads are formed at Erzrum. This lower plain is of inconsiderable extent, a basin among the mountains, in which the river of Mama-khatun (a considerable stream, which rises in the Bingol-tag near the sources of the Aras) and the Char-buhur, joins the Kara-su from the south-east. From the plain of Terjan the course of the Kara-su to its junction with the Murad-chai, a distance of about 134 miles, is in the general direction from north-east to south-west through a succession of difficult mountain-passes and narrow but fertile plains. The plain of Erzingan (interesting as having been, according to Osmanli tradition, the first settlement in Western Asia of Ertogrul, the ancestor of Kara-Osman, the founder of their dynasty) is about 20 miles long by 7 or 8 broad; the town of Erzingan, situated one hour and a half from its lower extremity, is about 30 miles from Kargan, the most southern village in the plain of Terjan. Mr. Brant found the grain ready for the sickle at Erzingan on the 6th of July, 1835, and the season was considered a backward one. The Dujik mountains bound the plain on the south, and the river runs close to their base. From Erzingan to Kemakh, a distance of about 26 miles, the Kara-su flows through a mountain defile, having the Dujik range on the left, and on the right mountains all but precipitous. The river is fordable with some difficulty at one or two places within this distance during the dry season. Immediately above Kemakh the river forces its way through a deep narrow chasm; and just before it precipitates its waters into this rent in the mountains it receives the Keumer-su from the west, a stream by which great quantities of wood are floated down. The Keumer-su descends from the plain of Divrigi, about 60 miles to the west, and which, according to Mr. Ainsworth, is 3116 feet above the sea. The valley of the Keumer-su has a considerable declivity, and the Kara-su must therefore have sunk at the point of their junction much below its level in the plain of Erzrum.

Kemakh is built on the east bank, a narrow and abrupt slope between the river and the precipitous mountains. From Kemakh to Egin is a distance of nearly 43 miles. At Khostu (nearer Egin than Kemakh) there is a ferry, at which the river is broad, rapid, and not fordable. There is sufficient water in the Kara-su between Kemakh and Egin to render it navigable for boats, but the frequent rapids, rocks, and shoals impede the navigation. At Egin the mountains rise from the banks of the river by a steep slope, which is terminated by abrupt precipices; the whole height of the mountains above the stream may be about 4000 feet, and the valley is so narrow that they seem to overhang the town. From Egin to the confluence with the confluence of the Kara-su and Murad-chai (about 35 miles), and thence to Kebban-Maden (about 5 miles farther), the channel of the river is obstructed by shoals and rocks, and only employed in floating timber-rafts. At the ferry near Kebban-Maden the river is about 120 yards wide, deep and rapid. The elevation of the confluence of the Kara-su and Murad-chai has not been ascertained. The elevation of the latter river at Palu is stated, by Mr. Glascott, at 2819 feet, and of Alishan (about two hours south of the break in the mountains by which the Murad-chai leaves the valley of Palu) 2781 feet. Malatiyah (38° 23′ N.), on the Tokhmah-su, about 10 or 12 miles west from its junction with the Euphrates, and about 50 miles distant below Kebban-Maden, is said, by Mr. Ainsworth, to be 2780 feet above the sea. There must be a mistake in one or both of these estimates, but they may be assumed to indicate the approximate level of the river-bed between Palu and Malatiyah. The Tokhmah-su rises more to the west than any other affluent of the Euphrates. The Injeh-su and the Balikli-su, which by their junction form this river, have their sources about 36½° E. long., and between 38½° and 39° N. lat., about 4000 to 5000 feet above the sea. Some of the affluents of the Jihun (Pyramus) are said to rise not far to the south west. The sources of the Tokhmah-su, of the Keumer-su, and of the stream rising near Kara-kulak, indicate the direction of the watershed at this part of the drainage basin of the Euphrates and Tigris. All these flow from west to east: the first has a course of upwards of 100 miles; the second probably of about 60, and the third of 30; and the course of the Euphrates, from the mouth of the third to the mouth of the first (upwards of 200 miles), is nearly from north-east to south-west.

Near the ferry of Fez Oglu, a few miles below the confluence of the Tokhmah-su, the Euphrates precipitates itself through a gap in the mountains which extend from east to west between the Murad-chai and the Upper Tigris, and curves through them with a general easterly direction to Gergen-Kalehsi, a distance of about 45 miles. In this part of its course the stream is hemmed in by lofty precipices and interrupted by rocks and small rapids, but warlike stores have been floated downwards on rafts. The subsequent course of the river as far as the mouth of the Saklawiyah canal (about 33° 25′ N. lat. and 40° 50′ E. long.), where it may be considered as having entered the central plain, is through an upland country, furrowed by alternate ridges and depressions, with a general declivity to the south-east. From Sumeisat (the antient Samosata), 45 miles below Gergen-Kalehsi, the Euphrates is navigable without serious interruption to the sea. From Sumeisat to Rum-kaleh, a distance of 51 miles, following the windings of the stream, the river flows S. 69° W. Its course thence to Balis (36° 1′ N. lat., 38° 7′ E. long.), a distance of 114 miles, winds along a line running north and south. Fourteen miles below Rum-kalah, at Graun, the channel of the Euphrates is only 80½ miles distant in a direct line from the Mediterranean at Bayas: 11½ miles east-south-east of Graun is Bir, or Birehjik: on the east bank, and nearly opposite (37° N. lat., 37° 58′ E. long.), is Port William, the station of the Euphrates expedition under Colonel Chesney. The Tigris steamer ascended the river as high as Bir. At this point the river is 628⅓ feet above the level of the Mediterranean at the mouth of the Orontes, from which it is distant 133 miles in a direct line, which gives only a fall of little more than 6 inches per mile to the Persian Gulf (distant 1117 miles), assuming the level of that sea to be the same as the level of the Mediterranean. Twenty-five miles below Bir the Euphrates receives from the west one arm of the Sajur, and 5 miles lower down another: this is a considerable affluent, the lowest of any importance that falls into it on that side. Thirty-nine miles below Bir the river passes Kalat en Nejm (Star-castle), the ruins of an observatory erected by Almámún, and 48½ miles farther on the ruins of the castle of Balis. At Balis the river is 101½ miles distant in a straight line S. 70° W. from the nearest point of the Mediterranean: the course of the stream turns here to the south-east, a general direction which, making allowance for its windings, it may be said to retain till it reaches the Persian Gulf. Near Rakkah it receives on the east bank the Belik, which rises near Harran, to the north. After a tortuous course of 80 miles (or 44½ in a straight line) S. 69° E., the Euphrates breaks through a chain of hills which comes on the west from Palmyra, and on the opposite side of the river, from the direction of Sinjar. In this pass the river flows in a small channel 250 yards wide and 7 fathoms deep, between precipices which rise abruptly 200 or 500 feet from the water's edge. Fifty miles from this pass, by the windings of the river, but little more than half that distance in a straight line, the Khabur (the antient Chaboras, and the Araxes of Xenophon) falls into the Euphrates from the north. About the 37th degree of N. lat., and between the 40th and the 42nd degree of E. long., is a range of heights (some of them 2500 feet above the sea) which extend from the Euphrates at Someisat to the Tigris north of Mosul, and form the southern boundary of the upper valley of the latter river. The streams which descend the south side of this range converge and unite a little to the north of the 36th degree of latitude, about the 41st of E. long., and form the Khabur. The southern boundary of this drainage basin is, on the west, the continuation of the range through which the Euphrates forces its way below Rakkah; on the east, the Sinjar Hills, which extend in the direction of Mosul. The Khabur enters the Euphrates in 35° 6′ N. lat., 40° 27′ E. long. From the Khabur to Werdi, 75½ miles by the river, 45½ in a straight line S. 33° E., the Euphrates has an average width of 400 yards, with an ordinary depth of 18 feet, and a current of 4 miles an hour during the floods: it forms many islands. Between Werdi and Anah (the antient Anatho) (92 miles, 50¾ miles east in a straight line) the river has at the same season a breadth of 350 yards, a depth of 18 feet, and a current of 4 miles an hour. About 100 miles below Anah the Euphrates passes Hit, well known for its bituminous fountains, which are mentioned by Herodotus (i. 178) under the name of Is. Seventy miles below Hit, at the mouth of the Saklawiyah canal, it has entered the great central plain. From Werdi to near the mouth of this canal a range of hills extends at a distance of some miles along the north-eastern bank of the Euphrates, the opposite declivity of which sinks to the bed of the Tarthar, a stream which rises in the Sinjar Hills, and flows south by east till it loses itself in a salt lake or marsh in the plain north of Bagdad. The high ground on the south-west side of the Euphrates extends a few miles farther to the south than that on the opposite bank; and at its termination, curving round to the north-east, approaches nearer the river, and terminates in an abrupt cape, surrounded on all sides by the level plains of Babylon.

Some discrepancy exists among travellers as to the exact portion of the course of the Euphrates to which the name Frat is applied by the natives. Morier states that the Kara-su is called the Frat in the neighbourhood of Mama-khatun; Brant, that the name Kara-su is retained till its junction with the Murad-chai, and that the united streams are known by the latter name as far down as Bir, whence to Kurnah, at the junction of the Euphrates and Tigris, the name Frat prevails. Probably different names are applied to the river by the different races resident on its banks.

The Tigris.—The principal source of this river is on the southern declivity of the mountain-range which forms the southern wall of the valley of the Murad-chai, between Mush and Alishan, and not much more than 10 miles distant from the most easterly point of the bend of the Euphrates, between Malatiyah and Someisat. The Tigris runs from its source 25 miles to the north-east, and its level can nowhere in this part of its course be lower than 4568 feet above the sea. It then flows southward for nearly the same distance, and receiving near the mines of Arghana-Maden a small stream from the west, adopts the course of this tributary, and flows towards Diar-Bekr (about 37° 55′ N. lat., 39° 55′ E. long.), distant 40 miles in a straight line. Opposite Diar-Bekr the Tigris is about 250 yards wide in the season of floods, but it is only used to float timber-rafts from the mountains. At Diar-Bekr the Tigris turns suddenly round to the east, and continues to flow in that direction for 105 miles, till it receives the Bitlis-chai, which rises on the south side of Nimrud-tag, a little to the west of lake Van. In this part of its course the Tigris flows parallel to the high mountains which separate its valley from that of the Murad-chai, an extensive plain intervening between its banks and their bases. On the south the river has the hill range, on the opposite side of which are the sources of the Khabur: these hills rise immediately from its bank. Forty miles below Diar-Bekr the Tigris receives from the north a large stream, which some have regarded as the main river: 35 miles farther on, in the direction of the Bitlis-chai, it is joined by a considerable affluent from the south. The elevation of the bed of the river in the valley from Diar-Bekr to the junction of the Tigris and the Bitlis-chai has not been satisfactorily ascertained; but the climate and vegetable productions are such as lead to the inference that it cannot be great.

From the point of junction the course of the Tigris bends round to the south, and it continues nearly in the direction of south-east to the mouth of the greater Zab (36° N. lat., 43° 20′ E. long.). For the greater part of this distance the range of hills which separates the valley of Diar-Bekr from the basin of the upper Khabur accompanies the Tigris on the south-east: they terminate on its banks a little to the north of Mosul (36° 20′ N. lat., 43° 15′ E. long.). Between the mouths of the Bitlis-chai and the greater Zab, the Tigris receives a number of affluents on both banks; the most important joins it about midway in this distance from the north, and is called, like the affluent of the Euphrates, which has been repeatedly mentioned, the Khabur. The Khabur, at its junction with the Tigris, comes from the north of east, but 30 miles farther up it comes from the north: of its upper course nothing is known, except that it must rise high up among the mountains which bound the southern shores of lake Van.

The main branch of the greater Zab has its sources at Koniyeh, Karasun, and Kashen, on the slopes of the Sar-al-bagh range, about 38° 30′ N. lat., at an elevation of about 7000 feet above the sea, nearly midway between the lakes of Van and Urumiyah. From the opposite side of the high plain in which these sources are situated, the waters run down to the Aras or to the lake of Urumiyah. The highest peaks of the mountains south of lake Van are to the east, Rowandiz (11,000 feet above the sea), the loftiest summit of the Jawur-tag, is to the east of south. At first the Zab flows to the south, but about 37° 19′ N. lat. it turns to the west-south-west. Near the village of Kiyau (about 37° 5′ N. lat., 43° 26′ E. long.) it receives the Berdizawi (called also by the inhabitants the Lesser Zab), which is said to rise in the Erdish-tag, a few miles south of the eastern termination of lake Van, and which descends to the principal stream in a succession of cataracts. After the junction the Zab flows south-east till about 12 miles east of Amadiyah, from which point its course is rather to the north of east, to 10 miles west of Rowandiz, where it receives a large affluent. Between Amadiyah and Rowandiz, the Zab has on the north the colossal mountains in which it has its rise; on the south a range of hills which stretch from near the mouth of the (Tigris) Khabur eastward to the base of mount Rowandiz. A lateral valley, which may almost be considered an extension of the valley of the Tigris from Diar-Bekr to below its junction with the Khabur, separates these hills from the mountains to the north. Turning round between the base of Rowandiz and the eastern extremity of this ridge, the Zab crosses a hill-range parallel to it on the south (apparently a continuation of the hills which from the west abut on the Tigris north of Mosul), and flows south-west to the Tigris, which it enters with a deep stream 60 feet wide.

About 84 miles below the mouth of the greater Zab the Tigris forces its way through the Hamrin hills, the south boundary of a plain extending from north-west to south-east, which is cut diagonally by the river in its course from Mosul. About 12 miles below the greater Zab there is a ford in the Tigris; 20 miles farther down it receives an affluent from the west near Kalah Shirkat; and 28 miles below this it is joined by the lesser Zab from the north-east. The main branch of this tributary rises 20 miles south-west of the south extremity of lake Urumiyah; flows 30 miles to the south-east, and then turns abruptly to the south-west; about 20 miles onwards it receives four affluents from the mountains to the south-east, and carries to the Tigris, after flowing parallel to the greater Zab for the last 50 or 60 miles of its course, a deep stream 25 feet broad. At the point of junction the Tigris has a breadth of 500 yards. Below the passage of the river through the Hamrin hills, high grounds, which separate its valley from the valley of the Tarthar, extend close to the termination of the mound which Dr. Ross calls the Median wall (34° 3′ N. lat., 44° 6′ E. long.). Here the Tigris issues from the hills into the great central plain. Between Diar-Bekr and Mosul (296 miles) the river is navigable for rafts at certain seasons; below Mosul it is navigable throughout the year: in 1838 the 'Euphrates' steamer ascended it to within 20 miles of Mosul.

The Diyalah.—This river, known in its upper course as the river of Shirwan, rises among the mountains, of which Mount Elwend, above Hamadan, is the best known, if not the highest summit, about 34° 40′ N. lat., 47° 30′ E. long. It flows for about 30 miles from east to west; then, turning at first to the north of west, for nearly 100 miles in a semicircular sweep round the base of Mount Dalahu, it receives in this part of its course, on its south bank, a number of streams, which, rising near the centre of the mountain-mass, flow like radii to the circumscribing stream. Some of the summits of this mountain-group rise, by the estimate of Major Rawlinson, 5000 feet above their base. At the most northern part of its course the Shirwan receives the waters of the Taj, one of whose branches comes from Suleimaniyah. It then flows south-east for about 30 miles, till it issues into the plain through a gap in the Hamrin hills, which are here not more than 200 feet above its level. The Diyalah receives in this part of its course the rivers from Zohab and Holwan from the east. Close above the Hamrin hills the Diyalah is, according to Rich, 400 yards broad, 'and the strong current rushes as from a sluice.'

The Kerkhah.—The main branch of this river rises on the south side of Mount Elwend, nearly in the same latitude with the Diyalah, about a degree to the eastward. It flows about 30 miles to the south-west, then receiving a stream from the east from Nahawend, adopts its course, and flows west for about the same distance. Major Rawlinson found the river fordable with difficulty at this part of its course in the month of May. Here it receives a stream from Kirmanshah on the north-west, and another from the high plain of Khawah, celebrated for its pastures, from the east and turns to the south. This direction it retains to Rudbar (nearly 60 miles in a straight line), where it receives from the west the river of Kirrhind, which has its rise south of the sources of the Holwan. The Kerkhah flows from Rudbar, to the east of south, through a narrow valley, having high rugged mountains on both sides (those on the west retaining the snow on their summits the greater part of the year), to Pul-i-tang, a distance of about 40 miles. In this part of its course the Kerkhah receives two considerable affluents, the Kashgan and the Zal, from the north-east. The mountains on its east bank, which separate it from the great central plain of the Tigris and Euphrates, are not of sufficient breadth to admit of their torrents attaining to great size. At Pul-i-tang, the Kerkhah, in general about 80 or 100 yards in width, forces its way through a narrow chasm, which a bold sportsman can spring across with ease. The cleft is about 150 feet deep; the sides are honeycombed in the most fantastic manner; and the river boils and foams below in its narrow bed. A short way below this the mountains to the west sink down, and the river enters the plain of Susiana; but just before reaching the ruins of Sus (about 32° N. lat.) it turns to the west, and, after a farther course of about 40 miles to the south-west, breaks through a low range of heights, and enters the great central plain about Hawiza.

The Kharun.—The Dizful, which has a much larger body of water than the stream which gives the name to the lower part of this river, is formed by the confluence of a number of streams in the neighbourhood of Burujird (about 34° N. lat., 49° E. long.), and flows through a difficult mountainous country to the town of Dizful (about 32° N. lat. and 48¼° E. long.). Ten miles below Dizful, the river runs to within eight miles of the Kerkhah, with an undulating plain between them. From this point the Dizful turns to the south-east and flows to Bund-i-kil (about 30 or 40 miles). Here it is joined by the Karun, which rises in the mountains to the east, about 32° N. lat. and 50¼° E. long. The Karun flows at first to the north of east, but its course where it joins the Dizful is to the south-east, and this course it retains to Hawaz, where it enters the great plain. At the town of Dizful, the bridge which crosses the river is about 330 paces in length.

The Jerahi is formed by the junction of the Zard with some other considerable torrents from the Mungasht hills, which in 31½° N. lat. are said to have snow on their summits throughout the year. A spur of these mountains advancing to the west, and gradually sinking to the level of the plain, forms the watershed between the Jerahi and the Indiyan (which falls into the Persian Gulf in about 30° 4′ N. lat., 49° 37′ E. long.), and terminates the drainage-basin of the Tigris and Euphrates on the south-east.

II. The declivity which forms the south-west boundary of the drainage-basin of the Tigris and Euphrates, from the base of the lofty mountains through which the latter river forces its way above Someisat, is very imperfectly known; and the little that is known of it leads to the belief that it is in the highest degree monotonous and uniform. The desert or great plains of Northern Syria, as this region is generally called, maintain an average elevation of 1300 feet. In the latitude of Aleppo the summit-level is situated between that town and the Euphrates, and the declivity towards that river slopes from north-west to south-east. Below the Bushir hills (the range mentioned above as extending to the Euphrates from the west side of Palmyra) the desert appears to have a general slope from the west of south to the east of north. There are no permanent watercourses in this region to indicate the declivity, but Lieutenant Ormsby, who crossed the desert in April 1831, from Hit (33° 38′ N. lat. according to Lieut. Murphy) to Damascus (33° 33′ N. lat. according to Niebuhr) observed on the fifth day (the day's journey averaging twenty miles) a phenomenon which at once points out the direction of the slope, and throws light on the peculiar character of the country. 'After two hours and twenty minutes, usually travelling west, we reached a large body of running water, flowing to the north-east at the rate of upwards of a mile an hour. After wading up to our knees in this for an hour, we reached a small rising ground. . . . . As the rain ceased the moving lake had passed away to the north-east, and was nearly out of sight. It was about eight miles broad, and extended in length as far as I could see. Where we waded through it it was knee-deep. The moving lake, I fancy, must continue its course till it is soaked into the soil, or till it settles in some low ground; the desert here is not even enough for it to stand.' On the eleventh day Lieutenant Ormsby was 11 hours south of Palmyra, and the gradual ascent of the plain still continued. On the thirteenth day he arrived at the east edge of a depression between the desert and the Syrian hills, which appears to be about 10 hours (25 miles) across. A similar depression appears to have been noticed by Mr. Addison at Palmyra, between the desert and the hills to the west. Burckhardt, when he reached the culminating point of the Jebel Hauran, south of Damascus, was told that the shallow wadi which he saw stretching to the east extended to the Euphrates. Colonel Chesney, who crossed the desert from Zoheir, west of Basra, observed that its surface was furrowed by a number of parallel shallow depressions extending north-east in the direction of the Euphrates. Captain Sadlier, who crossed the Arabian peninsula from El-Khatif on the Persian Gulf to Medina (between the parallels of 25° and 26° N. lat.), observed that wherever he met with running water along his route, its course was to the north or north-east. These are the only indications of the extent of the basin of the Tigris and Euphrates to the west and south-west that we have been able to glean.

III. The extent and maximum elevation of the great central plain of this river system has been mentioned above. The Tigris, it has been noticed, quits the last low hills in the vicinity of the north-east termination of the mound which has been called the Median wall (34° 3′ 30″ N. lat., 44° 6′ E. long.). The mouth of the Saklawiyah canal, which diverges from the Euphrates (about 33° 24′ N. lat., 43° 45′ E. long.), may be assumed as a near approximation to the point at which that river issues from the last low hills. Midway between these two points the plain appears to extend to the north of a straight line drawn from the one to the other, possibly along a continuation of the valley in which the Tharthar flows. From the end of the Median wall to the mouth of the Adhem (3′ to the south, and about 14′ west), the course of the Tigris is a little to the south of west along the termination of the undulating ground which extends from the base of the Hamrin hills; this direction it retains for about eight miles farther, and then turns to flow south to Bagdad (33° 20′ N. lat., 44° 25′ E. long.). Five miles below Bagdad the Saklawiyah joins the Tigris; the distance along this canal from river to river was found by Lieutenant Lynch (who sailed along it in 1838, in the Euphrates steamer) to be 45 miles. The current (in the season of floods) was about four miles an hour, from the Euphrates to the Tigris. On the parallel of Bagdad, the canal expands to a considerable lake, which again contracts into a narrow channel before it joins the Tigris. At 21 miles below the termination of the Saklawiyah, in the direction of S. 28° E., the Diyalah brings into the Tigris a large body of water. The Diyalah issues from the Hamrin hills about 16 hours north-east of Bagdad, and its course to the Tigris is extremely circuitous, describing nearly the figure of the letter S. A great canal called the Nahrawan, now broken and interrupted in its upper course, diverges from the east bank of the Tigris north of the Median wall, and joins the Diyalah nearly on the parallel of Bagdad. From the confluence of the Diyalah and Tigris the course of the latter is extremely winding, but its general direction is south-east. About 97½ miles in a straight line from Bagdad in that direction, it reaches Kut-el-amarah, a small town on its left bank, where a bifurcation takes place; and here the Tigris, instead of receiving an addition to its waters from the Euphrates, as by the Saklawiyah, sends a considerable stream to that river. The smaller branch, called Shat-el-hai, flows south and joins the Euphrates, after giving off a number of canals on both sides, about 140 miles from Kut-el-amarah: it is navigable throughout for light boats. The main branch of the Tigris turns off at that town to the north of east, with an apparently undiminished stream (200 yards broad), and flowing in that direction 28 miles, and then south by east 32 miles, reaches Imam Gharbi, the most distant part of its course in the plain from the Euphrates (95 miles in a direct line S. 22° W.). At 66 miles (by water) S. 57° E. of Imam Gharbi, a channel called Hud flows off on the east bank, and joins the Kerkhah near Hawizah: Mr. Rich's pilot had sailed along this branch. Ten or eleven miles below Imam Gharbi, the Tigris turns to S. 34° E., becomes deep and narrow, and makes a number of abrupt bends through a marshy plain for 40 miles to the tomb of Ezra. It there resumes its former breadth, and winds in a general south direction to its junction with the Euphrates at Kurnah, a distance of about 123 miles by the windings of the river. The current of the Tigris in the plain averages one mile and a half in the hour.

From the Saklawiyah, the Euphrates flows south-east, through a pastoral country, 42¾ miles, to the Mounds of Mohammed: it is here only 18 miles distant from the Tigris at the mouth of the Saklawiyah, and the ground has a gentle slope to the east. Within these 42¾ miles may be traced the remains of three parallel canals, branching off from the Euphrates to the east. From the Mounds of Mohammed the river flows across a flat barren country to Hillah (32° 28′ 35″ N. lat., 44° 28′ 40·5″ E. long.), 96¾ miles by water, or 67¼ in a direct line S. 33° E. of the mouth of the Saklawiyah. Hillah is almost due south of Bagdad, and between 50 and 60 miles distant from it. In this part of its course the stream has an average breadth of 200 yards, with an ordinary depth of 15 feet, and a current of barely two miles and a half an hour. From Hillah to a bifurcation a short way above Lemlun (a distance of 75½ miles by water, or 55¾ S. 31° E. direct), the volume of water in the Euphrates is materially diminished by canals of irrigation. The two narrow channels formed at this point reunite at Karayem (33½ miles S. 48° E. from the bifurcation), after flowing in short bends through a marshy country. On issuing from these marshes the Euphrates suddenly re-appears on its former large scale, inclosed between high banks covered with jungle. At 56¾ miles from Karayem the Euphrates is joined by the Hai, the branch which diverges from the Tigris at Kut-el-amarah; and 78 miles farther on it receives at Kurnah the waters of the main branch. The distance (by water) from the remotest sources of the Tigris to Kurnah is about 1146 miles, little more than half the length of the Euphrates. The Euphrates and Tigris now form one tidal channel, known by the name of the Shat-el-arab, about half-a-mile wide, which flows S. 37° E. almost in a straight line. Five miles below Kurnah, it is joined by the Kerkhah, which, near Hawiza, where it leaves the hills, receives the Hud from the Tigris, and in its subsequent course is believed to send off one or more canals to the Karun. From Kurnah to Basrah is 39½ miles by the river (36 S. 34° E. in a direct line); and thence to Mohammarah, where the Karun joins the Shat-el-arab, 22½ miles by water, or 20½ direct S. 70° E. Between Kurnah and Busrah the river has an average breadth of 600 yards, with a depth of 21 feet; between Basrah and Mohammarah, a breadth of 700 yards, and a depth of 30 feet. The current below Kurnah is two miles an hour during the flood and three during the ebb tide. Between Kurnah and Mohammarah the river forms five islands, all large.

The steamer 'Euphrates' sailed up the Karun in November, 1837, as far as Hawaz, where its progress was arrested by a ledge of rocks and an artificial bund. On descending the river, the Euphrates took three days to pass from Hawaz to Mohammarah. From Hawaz to Bund-i-kil (mentioned above in describing the course of the Karun before it enters the plain) the expedition was occupied two days in a country boat up stream, and one down stream. From Mohammarah to Sablah the course up the stream of the Karun was 20 miles nearly east; from Sablah (still ascending) to Ismaili, 40 miles nearly north; and thence to Hawaz about 30 miles north-east. At Sablah the Karun is joined from the east by the Dorak, a canal from the Jerahi; between Sablah and Hawaz there are no traces of canals, artificial or natural, joining or quitting the Karun on its east bank: midway between Sablah and Ismaili, the Karun is joined by a canal coming apparently from the Kerkhah. From Sablah a channel, called Karun-el-ama, formerly carried the waters of the Karun to the Persian Gulf, in a direction a little to the east of south. There is still a scanty stream in this channel, but it is supplied by the Dorak canal: the waters of the Karun are conveyed along the canal called Haffar to Mohammarah. The Karun-el-ama falls into the sea by two mouths—the eastern is called Khor Musa, the western Khor Seleje. From Sablah, ascending the Dorak canal to the village whence it takes its name, is 30 miles in a direction north of east; seven miles east of this settlement is the point at which the canal separates from the Jerahi. The country between Dorak and the Jerahi is irrigated by six other canals, in which most of the water of that river which does not find its way to the Karun appears to be dissipated. The antient river-bed, through which from this point the waters of the Jerahi appear to have found their way to the Persian Gulf, immediately to the north of Ras Tuloop, along a distance of about 40 miles nearly in the direction of south, contains only a scanty stream. At Mohammarah there is a bifurcation of the waters of the Shat-el-Arab: the Bahamishir, the lesser channel, has not been navigated throughout; the Mohammarah branch, the real Shat-el-Arab, flows south to the bar, which is 40 miles from Mohammarah, with an average width of 1200 yards, and an ordinary depth of 30 feet. The delta land between the western headland at the mouth of this channel and Ras Tuloop is almost entirely unknown to Europeans: of the ramification of the channels which connect the extensive gulf called Gubbet Nakada (between Khor Musa and Ras Tuloop) with the Jerahi or Karun we are quite ignorant. To the west of the Shat-el-Arab, a broad sound, called Khor Abdullah, stretches to the north-west between the mainland and the island of Boobian; into this arm of the sea some have supposed that the Pallacopas discharged itself, the artificial channel which in antient times commencing above the city of Babylon (on the site of Hillah) carried during the season of the floods a portion of the superfluous waters of the Euphrates into the flat country to the west. What seems the dry bed of a river, running parallel to the Euphrates, has in fact been traced at various points between Zoheir (west of Basra) and Hillah.

The physical structure of the region, the superficies of which has now been described, is varied and interesting, but as yet very imperfectly investigated. The mountains extending from the banks of the Euphrates above Someisat, west in the direction of the sources of the Sajur and Tokhmah-su, east to the sources of the Bitlis-chai, and the chain which extends thence between lake Van and the Murad-chai to the sources of the river Zab, form the southern boundary of the portion of the high table of Armenia, which belongs to the drainage-basin of the Euphrates. The geological structure of these mountains and of the whole basin north of them is pretty uniform. Granitic rocks are met with, but the igneous rocks believed to belong to later formations predominate. Metalliferous deposits exist at various places. At Divrigi on the Keumer-su boulders of native iron, some three feet long and one foot and a half thick, are found. At Keban-Maden, two hours below the confluence of the Kara-su and Murad-chai, are silver-mines. The ores are—argentiferous galena; a sulphuret of lead, silver, antimony, and iron; a sulphuret of antimony and silver. The ores are found in veins interposed between two different kinds of rocks—mica or chlorite slates, and limestone. At Arghana-Maden, near the sources of the Tigris, are copper-mines. The annual produce of these mines was said, in 1837, to be 150,000 maunds (2,250,000 lbs.). There are silver-mines farther east, in the same range. The mountains which from the source of the Bitlis-chai extend westwards to the south of lake Van, the mountains of which the lofty peak of Rowandiz appears to be the nucleus, and the mountains which from this point southwards form the east watershed of the drainage-basin of the Tigris and Euphrates, as far as they have been explored, present a similar conformation to the mountains just described. This eastern range terminates the high table-land of Iran and Azerbijan to the west, as the western terminates the high table-land of Armenia to the south. Veins of lead are worked in the upper valley of the greater Zab. The subalpine country intervening between both ranges and the central plain on the Euphrates and Tigris is pretty uniform in its structure. From the base of the western mountains, as far as Rum-kalah on the Euphrates, and extending north of a line passing from north-west to south-east through that point from the Tigris to the western boundary of the basin, cretaceous and supracretaceous deposits prevail, interrupted here and there by Plutonic rocks. The same formation extends east of the Tigris as far as the lesser Zab. Soft white chalk with flints prevails along the Euphrates to Balis; gypsum and marls predominate as far as the hills west of Palmyra, where they are covered with breccia; to the south limestone rocks, alternating with sandstones and clays, compose the elevated plain of the Syrian desert. At Hit are the celebrated fountains of bitumen and naphtha in a magnesian limestone. Around Mosul on the Tigris, and as far south as the west prolongation of the Hamrin hills, are red sands and sandstones. South-west of the lesser Zab are the Kufri hills, composed of fresh-water limestones, gypsum, and sandstone, with deposits of bitumen, naphtha, sulphur, and salt they contain the burning fountains of Kerkuk-baba. There are also naphtha fountains where the Tigris breaks through the Hamrin range. The Hamrin hills, from the Tigris to the Karun at Hawaz, are composed of saliferous red sands and sandstone. The great central plain from its northern termination to near the parallel of Bagdad has a slight but well-defined inclination to the south. The soil is pebbly. It is rare to find any deposits of pebbles farther south. A clayey soil succeeds, consisting partly of humus, partly of calcareous clay, covered with mould, or sand, or the tenacious clay of frequent inundations. Many local depressions occur in the plain between the Tigris and Euphrates, in all of which are marshes. The Lemlun marshes on the Euphrates are for the most part of a soft alluvial clay or mud containing only river and lacustrine shells. The plains south of these marshes rise only a few feet above them the soil is a deep-blue tenacious clay, covered in many places with a layer of sand, with marine shells. The marshes on the Tigris, below Imam Gharbi, are similar to the Lemlun marshes. Between Basra and Zobeir the soil is alternate mud and sand; to the south it is entirely of marine origin and contains sea-shells. The tract of alluvium between the Karun and Jerahi, and between the latter river and the sea, and extending as far west as the Bahamishir, is a nearly uniform plain, inundated during one-half of the year. In some places the earth is a compact calcareous clay, in others a loose soil full of saline particles. To the south the surface is covered with salt, which in some places lies on the earth like snow to the depth of an inch.

In the high land the climate is excessively cold in winter and in the valleys which furrow it the natives themselves complain of the excessive heats of summer. The warm days and cold frosty nights of spring forward vegetation and preserve the snow at the same time. In February the snow has been known to be two feet deep on the hills and hard enough to bear a horse: yet on occasional bare spots the crocusses might be seen in blossom. The atmosphere of the subalpine regions is extremely dry and liable to great variations of temperature. From the west boundary of the basin to the Tigris, there is an increase of cold in the same parallels; east of that river the plains sheltered by the mountains have a more temperate winter. At Bagdad the heat from April to October is intense; the thermometer generally rises during the day to 115° in a shady verandah. Rich mentions having seen it as high as 120° in the middle of the day and 110° at night. The intense heats of the Persian Gulf are notorious. The basin of which that gulf and the plain at its northern termination are the maximum depression, is landlocked on every side, and this depression lies within the 10 parallels of latitude next adjoining to the tropic of Cancer. The extraordinary heat occasioned by the want of the regular winds which sweep less confined regions, the immediate vicinity of mountains covered with eternal snow to the north and east, and the comparative depression of the elevated land which separates this basin from the meridian, account for the occurrence of those tremendous storms, one of which overwhelmed the Tigris steamer in the Euphrates expedition.

The high plains at the sources of the Kara-su and Murad-chai are destitute of timber-trees. The valley of the Murad-chai in the vicinity of Mush is also bare, but there are oak forests in the recesses of the southern mountains. From Palu to Mush there are extensive forests of oaks along the bases of the mountains which bound the valley on the north, but the trees are small. In the valley of the Kara-su walnuts, pines, and firs flourish as high as Mama-khatun; considerable quantities of timber are floated down from the mountains near Divrigi; at Egin above Kebban Maden, the white mulberry abounds. The lower valley of the Tokhmah-su is said to resemble a garden; dwarf oaks flourish nearly to its upper extremity.

The vine is cultivated with success as high as Egin on the Kara-su and Mush on the Murad-chai. Wheat of a fine quality is grown in the plain of Erzrum. The soil of the plain around Diyadin is rich, but principally pasture. Forests occur at intervals along the road from Bir to Mosul; northward as far as Arganah-Maden there is no wood. Along the bases of the mountains between Diyar-Bekr and the Biltis-chai the country is at intervals well wooded. Pines, oaks, and ashes are the prevailing forest-trees in this region and among the Persian mountains. All over the southern declivity of the mountains the vine, fig, and almond-tree, pears, apples, and apricots, the olive, and wheat are cultivated, and yield ample returns. The Platanus Orientalis attains an enormous size. Between the parallels of 34° and 37° timber-trees are scarce. The forest of Aran on the Euphrates consists entirely of tamarisk, poplar, and white mulberry. There is an extensive forest on the west bank of the Tigris between Mosul and Kalah-Sherkat (about 35° 30′ N. lat.). In this region there are few annual and tender plants; the tough stems of perennials alone seem able to withstand the excessive variations of temperature: wormwood is the characteristic plant east of the Euphrates, camomile and the camel-thorn to the west. The ground is gay in spring with bulbous and liliaceous plants and Orchideæ. In the central plain the date-palm is the only important tree: as far north as Bagdad the supplies of building timber and firewood must be floated down from the upper Diyalah or Tigris. The most northern date-groves are met with at Anah on the Euphrates, and they continue increasing in number and quality to the southern termination of the basin. That they are unequally distributed over the surface is solely owing to want of cultivation: for the reports of Xenophon and the Arab geographers and historians show that they once abounded in tracts which are now bare; and modern experience confirms that careful irrigation alone is wanted to make any part of this region produce them in plenty. The woody and spiny plants of the region interposed between the mountains and the central plain give place in the latter to succulent species, most of which belong to families indicating a strong saline admixture. Mesembryanthema and asters cover the great level tracts of Babylonia, Chaldæa, and Susiana. The marshes have a luxuriant vegetation of coarse grasses, rushes, and reeds. The shallow sheets of water dispersed among the reed-marshes are covered with the broad leaves, and in their season with the flowers, of Nymphaceæ and Ranunculaceæ. The river-banks are fringed with tamarisks, acacias, and occasional groves of a species of poplar (gharah), which from the form of its leaves has been mistaken for a willow. On the sea-shore is found a species of Mariscus, which in the flowering season presents a rich green carpet relieved by the glistening though somewhat sombre colours of its spikelets. The roots of this plant are fibrous, and take a strong hold of the soil: they give solidity to large masses of alluvium, and where the Mariscus has spread the land may almost be regarded as permanently gained from the sea.

In the mountain-region the animal kingdom has not yet been subjected to the observation of scientific inquirers. Wolves, bears, lynxes, sables, and foxes are frequent; there are large herds and flocks of the common domesticated animals; all kinds of accipitres and several owls abound. In the hill-country and the plain the lion is found from the mouth of the Khabur northward. A species of the hunting tiger and a great variety of allied species are met with on the lower Tigris and Euphrates. The lynx inhabits the woody districts, in which squirrels are also numerous. From the mountains to the sea the hyæna is the most common animal: a white variety has been observed. The otter is found in the Euphrates, Tigris, and Karun. Wild boars are numerous in all localities adapted to their habits; and an animal called the wild horse is met with among the uplands between the Tigris and Euphrates. The jerboa is frequent on the plains. The fallow-deer is common in some districts, and gazelles are numerous in the Syrian desert, over all the subalpine country, and as far as the delta land of the united rivers. Herds of buffaloes wallow in the marshes of the plain. The bat tribe are numerous. The camel, two breeds of horses, and a fine race of asses are the most important domestic animals. Vultures are common in the towns; hawks and owls among the crags of the subalpine country. The thrush, lark, and bulfinch are common: the bulbul of Syria is the English nightingale; the Persian bulbul is a kind of thrush. There are some brilliant and peculiar species of kingfishers. Pheasants and various species of partridges are common; the quail scarce. Reptiles of all kinds are numerous. The fish and insects have been very cursorily examined.

In no region out of Europe have the original races of men been more intermingled and confused than in the great basin of the Tigris and Euphrates. The successive conquering dynasties of the Assyrians, Medes, Persians, Greeks, Parthians, and Arabs, have all fixed here the central seats of their power, and shifted and blended the tribes subjected by their arms. The period during which the frontier-lines of great empires have intersected the region—in old times the frontier of the Roman and Parthian empires—in our own day that of the Ottoman and Persian—have been scarcely less efficacious in producing this confusion. Among the mountain-chains and valleys of the Armenian plain, a relic of the race from which it derives its name has continued tolerably pure from the earliest times. Their neighbours the Kurds are probably the representatives of the old Carduchioi, but more mixed. The Chaldæans on the upper waters of the greater Zab are also to all appearance a primitive race. The now dominant races within the basin are the Arabs (tolerably pure), the Turks (the nomade tribes, not much mixed; the town settlers, a race of multifarious lineage), and the mixed race called Persians. The districts in which each of these races predominate are pretty sharply defined. The Arabs preponderate to the south of Bir and Mosul, and west of the Tigris, the Shat-el-Hai, and lower Euphrates. The Turks preponderate to the north of the Arabs, and are numerous among the haunts of the Kurds and Armenians. The tribes called Persian prevail south of the Diyalah and east of the Tigris; and south of the Shat-el-hai and east of the Euphrates the greater part of the population appears to be composed of clans of this mixed race.

Rennell and D'Anville have done for the comparative geography of this region all that a talent almost approaching to the power of divination could do with the materials they possessed. The progress that has been made since they wrote, in extending and rectifying our notions of its actual condition, render it desirable that the data of old historians and geographers were again compared with the positive geography of the country, in order to correct their conclusions. The first lesson to be learned here is to what our actual knowledge amounts. The tract of which the geography may be considered as ascertained with something approaching to certainty extends, it has been seen, from the delta of the rivers to Bir or Someisat on the Euphrates, to Mosul on the Tigris, and to Hawaz on the Karun. Our acquaintance with the table-land of Armenia and with the west slope of the table-land of Iran has been extended and corrected, but not to the same extent. For the purposes of comparative geography the actual condition of this tract has to be compared with the writings of the Hebrews, the Greeks and Romans, the Armenians, and the Arabs, taken in connection with the light surviving monuments throw upon them. The first thing to be looked to is the river courses. The channels of the Tigris from Mosul to the delta, and of the Euphrates from the delta, may be considered as identified with the rivers so named by the Greeks and Romans. The Euphrates, there can be no doubt, is the 'great river' of the Hebrews. The Kerkhah may be held to be identified with the Choaspes, the Karun and Dizful with the Pasi-tigris and Coprates, the Shapur with the Eulaeus. These lines being determined, give us Babylon at Hillah; Is at Hit; and Susa or Shusan on the Shapur, between the Dizful and Kerkhah, at the points of their nearest approach. Susa gives us the approximate positions of the province of Susiana and Elymais to the east of it, and the city of Ecbatana to the north-east. The route of Xenophon enables us to identify the Khabur (the affluent of the Euphrates) as his Araxes: the Saklawiyah and its parallel canals as the district where the battle in which Cyrus fell was fought; some mounds north of Bagdad between the Khor and the Tigris as the approximate position of Sitace; the mouth of the Athem as the approximate position of Opis; the lesser Zab as the Zabatas (of Xenophon); the vicinity of Mosul as the place whence roads diverged west to Syria and Cilicia, south to Babylon, east to Ecbatana and Susa, and whence the Ten Thousand struck into the hill region. The same author enables us to fix, with something approaching to precision, the relative positions of the Babylonia, Media, the countries of the Karduchians and Armenians of his time. The routes of Ammianus Marcellinus enable us to identify the Khabur (of the Euphrates) with his Aboras, and the town Circesium with the ruins in that vicinity; to ascertain the site of Ctesiphon, 25 miles below Bagdad on the Tigris; to identify Hatra with the ruins on the Tharthar, which have been visited by Dr. Ross and others; and to fix approximately the positions of his Singara, Nisibis, and Amida. The history of Zenobia enables us to identify Tadmor (Palmyra) and Zenobia on the Euphrates (the modern Zelebi). Around the central district here indicated there are materials for identifying other scenes of antient history, but the work has yet to be done in a judicious and critical spirit.

It would be unjust to conclude this article without intimating our obligations and expressing our gratitude for the liberality with which Colonel Chesney, the commander of the Euphrates expedition, has complied with our request for information respecting the regions explored by it. We may also be allowed to express an earnest wish that the publication of the results of that expedition's labours will not be much longer delayed. In spite of many obstacles, the expedition succeeded, in the course of the years 1835, 1836, and 1837, in running a line of levels from the Mediterranean to the Euphrates; collecting materials for a correct map of northern Syria; exploring northern Mesopotamia; surveying the Euphrates from Bir to the sea; exploring the Tigris for 400 miles above its junction with the Euphrates; exploring the great delta of Susiana; running a second line of levels from the Tigris to the Euphrates across the plain of Babylonia; and traversing the Syrian desert by several routes. Valuable observations, especially in the departments of zoology and geology, were made by the naturalists attached to the expedition. Numerous astronomical observations were made by Lieut. Murphy (who fell a martyr to the zeal with which he devoted himself to the task), and have been reduced by the Rev. R. Sheepshanks; an important series of pendulum experiments were made at Basra by Major Estcourt and Lieut. Murphy. The last-named gentleman was unfortunately not the only member of the expedition who fell a victim: the loss of the officers and great part of the crew of the steamer 'Tigris,' in a hurricane near Salahiyeh, had also to be regretted; and Colonel Chesney suffered severely in his health, though his high spirit carried him through. The publication of the fruits of all this toil and loss of life will be valuable, not only as an addition to science and historical geography, but as a means of corroborating or correcting the East India Company's chart of the Persian Gulf.

(*Communications from Colonel Chesney; Papers by the Officers of the Expedition under Colonel Chesney*, in the *Journals of the Royal Geographical Society of London* and of the *Geographical Society of Bombay*; Rich's *Koordistan; Travels* of Morier, Fraser, and Ainsworth; Martin. *Mémoires sur l'Arménie; Papers in the Journal of the London Royal Geographical Society*, by Viscount Pollington, Professor Long, Mr. Consul Brant, and Mr. Suter; Parrott's *Journey to Mount Ararat; Chart of the Red Sea*, published by command of the Hon. East India Company.)

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U.

U is at one extremity of the series of vowel sounds, lying next to the vowel *o*. In the Hebrew alphabet it does not appear, and was probably originally wanting in that of the Greek tongue. For the different forms of the letter see ALPHABET.

1. The close connection between this vowel and the vowel *o* might be inferred from their relative position in the vocal gamut, and has been already the subject of remark under the article O.

2. *ū* is interchangeable with the diphthongs *oe* or *oi* in Latin. Thus cūra, ūtor, ūnus, mūnio, mūrus, often appear in the older dialects of that language as coira or coera, oitor or oetor, oenus (observe the *w* sound at the beginning of the English word *one*), moinio or moenio, moerus. Hence the verb ūro is probably connected with oestrum, and also with aestus, aestas, as well as Vesta, Vesevus. In the same way foetus, foecundus, are formed from the old verb fuo, by the addition of the common suffixes *tus* and *cundus*, which are so often attached to verbs. Again the variation in the forms of Poeni and Punicus is an example of the same principle. It may be added, that all the words munus, munire, communis, immunis, munia, murus, are connected both in form and meaning with the Greek words, such as *μοιρα*, denoting *division*.

3. *u* with *au*, as in the Latin forms claudo and cludo, and the Latin mus compared with the German maus, a mouse.

4. A short *u* with *ă*. Thus those who represent the Arabic article in English characters are divided between al and ul.

5. A short *u* with *ĕ*. Thus the Greek tongue, or rather pen, prefers the syllable *el* where the Latin writes *ul*, particularly in the penult syllable: as Σικελος, Siculus: compare also the cry *ελελελευ* with the Latin ululare. The Germans again prefer *el*. Hence the Latin tabula, fabula, appear in German as tafel, fabel. The vowel *u* is also preferred by the Romans before *n*, if a *d* or *t* follow. Hence rediens has a genitive redeuntis, and faciundus is as common as faciendus.

6. A short *u* with *ĭ*. See I., s. 2.

7. For the interchange of *du* with *b* and *v*, see B, D.

8. For the interchange of *l* with *u*, see L.

9. *Ou* not unfrequently results from *on*, particularly in the Greek language, as *οδους* for *οδονς*; *τυπτουσι* for *τυπτοντι*; and the accusative plural of the second declension, *οικους*, is a corruption of *οικονς*, being formed from the singular *οικον* by the addition of the affix for plurality. Mr. Payne Knight appears to be wrong in inserting a digamma in this form.

10. For the loss of an initial *c* before *u*, see C. In confirmation of what is there stated, it may be observed that *uter* appears in an inscription which is determined by its contents to belong to the Augustan æra, in the form *cuter*, at least *neuter* is written *necuter*. The copyists, scandalized at such a form, altered it into *nec vero*, to the utter annihilation of the sense, until Marini again restored the true reading of the stone.

11. The insertion of a *y* sound before *u* is not limited to an initial *u*, as in union, university; but occurs in the middle of words. Thus, in Norfolk 'true' is sometimes pronounced 'tryoo.' It is probably in this way that the English have adopted the orthography *ew* in so many words, as new, few.

12. For the intimate connection of *u* with V and W, see those letters.

U'BEDA, a city of Andalusia in Spain, situated at the foot of a mountain called los Cerros de Ubeda, in 37° 56′ N. lat., 3° 24′ W. long., between the rivers Guadalquivir and Guadalimar. Since the new division of the Spanish territory, Ubeda belongs to the province of Jaen. Alfonso IX. of Leon took it from the Moors on the 16th of July, 1212, immediately after the battle of las Navas de Tolosa; but the garrison which he left in it being too scanty to defend the city against the Moors, it was evacuated by the Christians, and set on fire. The Moors retained possession of it until the 29th of September, 1239, when it was retaken by Fernando III. The inhabitants, together with those of Baeza and other cities which were reduced about the same time, betook themselves to Granada. The plain on which Ubeda stands is among the most fertile of Andalusia, and yields abundant crops of grain and oil, which are carried into the interior. The population amounted, in 1826, to 15,774 inhabitants, most of whom are occupied in agricultural pursuits; the rest find employment in the manufactures of coarse cloth, blankets, and hats. Ubeda celebrates an annual fair, which is much frequented by the inhabitants of the provinces of Cordova and Jaen, on the 29th of September, in commemoration of the taking of the city from the Moors. (Miñano, *Diccionario Geográfico*; Mariana, *Hist. Gen. de España*, lib. xvi.)

UBERTI, FA'ZIO DEGLI, of a Guibeline family of Florence, is believed to have been a son of Lapo degli Uberti and grandson of the great Guibeline leader Farinata degli Uberti, who after the defeat of the Guelphs at Monteaperto, saved Florence from the fury of his own party which wanted to raze the town to the ground. Of the personal history of Fazio little is known, except that he lived in the middle of the fourteenth century, that he was an emigrant in consequence of the proscription of his party by the triumphant Guelphs, and that he found an asylum at various Italian courts, among the rest at that of the Visconti at Milan, amusing his patrons by reciting verses. Some of his canzoni and other small poems are found in various collections. He composed also a descriptive poem in terza rima, entitled 'Il Dittamondo,' from the Latin words 'dicta mundi,' the 'sayings' or 'the news of the world,' in which, borrowing the plan of Dante, he represents himself travelling about the world in company with Solinus, the author of the 'Polyhistor,' and describes the various countries, their history, the contemporary sovereigns, and other things worthy of note. The poem contains six books, subdivided into cantos, but is not complete. It is written with graphic concision and energy of style, and is interesting as a memorial of the geographical information of that age, mixed with fabulous traditions and mythological lore.

The 'Dittamondo' was printed at Vicenza in 1474, and reprinted at Venice in 1501, both editions being however full of errors. An improved edition, with corrections by Monti and Perticari, was published at Milan in 1826. Fazio is said, by Filippo Villani, to have died at Verona, after a quiet old age. (Tiraboschi, *Storia della Letteratura Italiana.*)

UBES, ST. [SETUBAL.]

UCAYALI, River. [AMAZON; PERU.]

UCCE'LLO, PA'OLO, a celebrated old Florentine painter, contemporary with the sculptors Ghiberti and Donatello, who would, in the opinion of Vasari, have been one of the most remarkable painters that had lived, from Giotto until Vasari's own time, had he bestowed as much labour on men and animals as he did on perspective. Uccello was the first Italian artist who reduced the principles of perspective to rule: he was acquainted with geometry as a science, which he learnt of his friend the mathematician Giovanni Manetti, with whom he used to read Euclid. He painted in fresco and in distemper, but most of his works are now destroyed. His pictures were generally of such subjects as admitted of the introduction of animals; and he contrived in all his works to display his power of foreshortening. His best works were those painted in Santa Maria Novella, in green earth, where he illustrated the histories of Adam and Eve, and of Noah, the creation, and the deluge. In these works he painted numerous animals,—amongst them many birds. He acquired his name of Uccello on account of his predilection for painting birds. Vasari does not mention his family name: it was not Mazzocchi, which is a name given to him by Orlandi through misunderstanding a passage in Vasari. He was skilful also in landscape-painting, and the backgrounds of some of his paintings were the best specimens of this department of art that had been produced up to his time.

Uccello painted also in green earth, in the cathedral, a colossal equestrian portrait of an Englishman, who was a captain of the Florentine republic, and who is called Giovanni Aguto by Italian writers: he died in 1393. This painting still exists, and is marked at the base, Pauli Uccelli Opus. He had a high opinion of his proficiency in his own peculiar line, and he painted on the same panel his own portrait, with the portraits of four other men distinguished in different arts or sciences. He painted Giotto for painting, Brunelleschi for architecture, Donatello for sculpture, himself for perspective and animal painting, and Giovanni Manetti for mathematics. He died, according to Vasari, in 1432, aged eighty-three, very poor, having latterly devoted his whole time to perspective, which was a very unprofitable study to himself, although succeeding artists derived great advantages from his labours. Bottari supposes 1472 to have been the date of Uccello's death.

(Vasari, *Vite de' Pittori, &c.*; Lastri, *Etruria Pittrice.*)

UDALL, NICHOLAS, was born in Hampshire, in 1506. He was admitted a scholar of Corpus Christi College, Oxford, January 13, 1520, and took the degree of B.A. September 3, 1524. After he left college he became master of Eton school, and obtained the degree of M.A. in 1534, which had been refused to him at college on account of his inclination to the tenets of Luther. He was afterwards master of Westminster school. In the early part of the reign of Edward VI. he was appointed to a canonry at Windsor. He died in 1564.

Udall published 'Flovres for Latyne Spekynge,' London, 1533, which consists of selections from Terence's comedies, with an English translation; he also published translations from some of the Latin works of Erasmus; but his chief claim to notice is, that he was probably the first writer of regular English comedies divided into acts and scenes. Wood says that he wrote several comedies, all of which however had been lost, till a printed copy of one of them was discovered in 1818: this is 'Ralph Royster Doyster.' An account of this comedy is given in English Drama, vol. ix., p. 429; and in *The Pictoral History of England*, vol. iii., p. 579. Udall also wrote, probably for his scholars at Eton, a Latin tragedy, 'De Papatu,' 1540.

John Heywood, born at North Mims, in Hertfordshire, was a dramatic writer contemporary with Udall. He also was educated at Oxford. He died in 1565, at Mechelen (Mechlin). Heywood's plays however were shorter, and less artistically constructed than Udall's, consisting of only a single act, and were rather interludes than comedies. For an account of Heywood's productions, see English Drama, p. 428; and *Pictorial History of England*, vol. iii., p. 579. John Heywood should not be confounded with Heywood, Thomas.

(Baker's *Biographia Dramatica*, by Reed and Jones; Watt's *Bibliotheca.*)

UDDEVALLA. [Sweden.]

U'DINE, PROVINCE OF, a division of the Venetian territories, now forming part of the Lombardo-Venetian kingdom subject to the crown of Austria. It is divided into twenty-one districts: Udine, San Davide, Spilimbergo, Maniago, Aviano, Sacile, Pordenone, San Vito, Codroipo, Latisana, Palma, Cividale, S. Pietro, Faedis, Moggio, Paluzza, Rigolato, Ampezzo, Tolmezzo, Gemona, and Tricesimo. The whole population is about 340,000. A description of the country is given under Friuli. The principal towns are, 1, Udine, the capital, situated in an elevated plain, near the foot of the Carnic Alps, and about 20 miles from the sea-coast of the Adriatic, and on the high road from Venice to Vienna. Udine is a walled town, between four and five miles in circumference. Upon an eminence in the middle of the town is the old castle, once the residence of the patriarchs of Aquileia, who were for several centuries lords of Friuli. The patriarchs of Venice have succeeded to the spiritual jurisdiction of the patriarchs of Aquileia. Udine is a bishop's see: it has some fine churches, among others the cathedral and the church of S. Pietro Martire; and several palaces of the nobility adorned with good paintings, a handsome square lined with arcades and adorned with a fountain, several good streets, a communal gymnasium, a royal lyceum, a clerical seminary, three colleges for the education of females, several public libraries, the Museum Bertolini, the Museum Antonini, an agricultural academy, a philharmonic institute, a monte di pietà, a theatre, and nearly 20,000 inhabitants. A considerable trade in silk, the produce of the country, is carried on at Udine. There are silk and leather manufactories, and a sugar-refinery. The surrounding country is fruitful and well watered, and the climate is healthy and pleasant. About two miles from Udine is the village of Campoformio, memorable for the treaty of peace of 1797 between General Bonaparte and the Austrian plenipotentiaries, in which Venice was erased from the list of nations. Udine is the birth-place of the historian Giovanni da Udine, of a painter of the same name, of the scholar Robortello, professor of classical literature at Lucca, Pisa, Bologna, and Padua in the sixteenth century, and several other learned men. 2, Cividale, with 4000 inhabitants, the antient Forum Julii, which has given its name to the whole country, and where important remains of antiquity have been recently dug out, chiefly by the care of Count Michele della Torre, assisted by the Imperial Austrian government. 3, Pordenone, near the borders of the province of Treviso, a thriving town of 5000 inhabitants, with manufactories of linens and paper. 4, Spilimbergo, on the banks of the Tagliamento, a town of considerable trade. It is the birth-place of Irene da Spilimbergo, a female painter of some note. 5, Palma Nova, a fortress, important for its situation on the eastern frontier of Italy.

(Liruti, *Notizie dei Letterati del Friuli*; Maniagò, *Storia delle Belle Arti Friulane*; Palladio degli Olivi, *Historie della Provincia del Friuli*, 1660; Maniagò, *Guida d'Udine*, 1825; Rampoldi, *Corografia dell' Italia.*)

U'DINE, GIOVANNI DA. [Nanni.]

UELZEN is a small town in the principality of Lüneburg, in the kingdom of Hanover, in 52° 56′ N. lat. and 10° 32′ E. long. It is situated in the middle of the Lüneburg heath, on the river Ilmenau, the two arms of which surround the town, and has a wall and moat with three gates. The population is about 3000. They cultivate flax of a very superior quality, have manufactories of linens, camlet, woollen cloth, and starch: there is likewise a brandy-distillery and a paper-mill. There are no public buildings, except one church and two hospitals. The inhabitants carry on a considerable trade, and the annual fairs, for horses, cattle, and flax are much frequented. There is in the neighbouring country a good breed of horses, of which the stallions are highly valued. Uelzen is the birthplace of Professor Eberhard Augustus William von Zimmermann, the well-known geographical and political writer, who travelled in France, Italy, England, Russia, and Sweden: he visited England several times, and published in London his 'Political Survey of the present State of Europe,' 1788. In his later works (after 1806) he expressed himself on the subject of the French tyranny with a freedom which frequently exposed him to personal danger. He died on the 10th of June, 1814, in the 72nd year of his age. (Brockhaus, *Conversations Lexicon*; Hassel, *Handbuch*; Stein, *Handbuch der Geographie*, edited by Hörschelmann.)

UFFCULM. [Devonshire.]

UFFENBACH, ZACHARIAS CONRAD VON, a learned German, was born on the 22nd of February, 1683, at Frankfort-on-the-Main, where his father was a senator, and belonged to an antient and noble family of the place. He was educated at the gymnasium of Rudolstadt, whence he proceeded in 1698 to the university of Strassburg to study law. In 1700 he lost both his parents, which obliged him to return to Frankfort; but as soon as he had got over his grief he went to Halle, where he completed his academical studies, and in 1702 he took his degree of doctor of law under Christian Thomasius, after having written an inaugural dissertation, 'De Quasi-emancipatione Germanorum occasione Reformationis Francofurtensis.' Uffenbach from his youth showed a great love of books, and while he was at the universities he considerably increased the library left him by his father. After completing his studies, he travelled for two years through Germany, and collected MSS. and rare books. In 1704 he returned to Frankfort and settled there. The next five years were chiefly spent in completing his library, which became one of the most extensive private collections in Germany. In the mean time some offer was made to him at Oxford, and it was partly with a view to see whether the offer would suit his taste, and partly with the view of making some acquisitions for his library, that in 1709 he visited England, and spent some time at Oxford. But various circumstances, and especially the English climate, which did not agree with his delicate constitution, induced him in 1711 to return to his native place. He brought back with him upwards of 4000 rare and curious books, which he had purchased in England and Holland. In 1721 he was raised to the rank of a senator of Frankfort, and distinguished himself so much among his fellow-citizens, that in the course of nine years he was twice elected mayor: in 1731 he was raised to the office of chief-justice. He died on the 6th of January, 1734.

Uffenbach was a man of extraordinary diligence. As long as his health permitted it, he devoted all his leisure time to bibliographical and other studies, and to the composition of most laborious works. He made and published three different catalogues of his library; one in 1720, and another in 1729, under the title 'Bibliotheca Uffenbachiana apocrypha vel latens, hoc est, librorum in corpus redactorum vel aliis insertorum Catalogus.' This catalogue was believed to have been made by the author with a view of disposing of some parts of his library, as his official duties prevented his attending to it as much as before. A third catalogue, in 4 vols. 4to., was published after Uffenbach's death in 1735. Besides these catalogues he commenced several other works, but was prevented from completing them partly by his official engagements, and partly by ill health. These works were,—1, 'Glossarium Germanicum Medii Aevi'; 2, 'Commentarius de Vita propria,' that is, an autobiography; 3, 'Selecta Historiae literariae et librariae,' the MS. of which formed several quarto volumes; 4, 'Adversaria, sive Excerpta Realium ad Rem Librariam et Literariam facientium,' in nine quarto volumes. The work most advanced towards completion was Uffenbach's autobiography; but when in the latter years of his life he lost all hopes of ever finishing his works, he gave the MSS. of them to his friend J. G. Schellhorn of Memmingen, together with his literary correspondence, forming eighteen thick quarto volumes, and allowed him to make any use of them he pleased. Schellhorn did not indeed complete or publish the works thus bequeathed to him, but he made much use of the materials collected by Uffenbach for his 'Amoenitates Literariae,' in the ninth volume of which he gives an account of the earliest printed works contained in the library of Uffenbach. He also wrote a Life of his friend, which is prefixed to a collection of Uffenbach's letters, 'Commercii Epistolaris Uffenbachiani Selecta,' &c., 1753, &c., 5 vols. 8vo.

UGGI'ONE, or UGLO'NE MARCO, called also Marco of Oggione in the Milanese, was one of the best scholars of Lionardo da Vinci. He did not, like most of the disciples of that great master, confine himself to easel pictures, executed slowly and highly finished, but became an eminent painter in fresco, and his works in the Place at Milan have retained even to our time their tone and colour unimpaired. Some of them are in the body of the church, but the most remarkable of them is in the refectory: this is the Crucifixion, which is equally admirable for the skill evinced in the composition, the spirited execution, the variety in the numerous figures, and the taste of the draperies. For the refectory of the celebrated monastery of the Certosa, near Pavia, he made a copy of The Last Supper of Lionardo da Vinci, which is peculiarly valuable on account of the ruinous condition of the matchless original.

The church of St. Euphemia, at Milan, contains one of his masterpieces, representing the Virgin and Saints. He died in 1530, but his age is not known.

(Pilkington; Fuseli, *Dictionary of Painters;* Mariana Starke, *Travels in Europe*, 10th edition, London, 1839.)

UGHELLI, FERDINANDO, born at Florence about 1595, entered the order of Cîteaux, in which he rose to the dignity of abbot. He is chiefly known for his great work, 'Italia Sacra,' published at Rome, in 9 vols. fol., 1642-8, in which he gives the history of the various Italian sees, with the series of their respective bishops, and illustrates them by numerous documents from the episcopal archives, which also reflect much light on the general history of the country. As it was impossible for the author to examine himself all the archives of the numerous Italian sees, he was often obliged to employ others; and the consequence is, that the execution of the work is unequal. Still Ughelli's history is very valuable, and has served as a model for similar compilations of the episcopal history of other nations, and especially of that of France, which was published about fourteen years after the appearance of Ughelli's first volume, under the title of 'Gallia Christiana,' in 1656. A new edition of Ughelli's work was published at Venice, in 10 vols. fol., 1717-33, with considerable additions, and with the 'Sicilia Sacra' of Rocco Pirro.

Ughelli wrote a work in illustration of the history of the Colonna family, 'Imagines Columnensis Familiæ Cardinalium,' Rome, 1650; and another work in Italian, entitled 'Albero e Istoria della Famiglia de' Conti di Marsciano, Rome, 1667. Ughelli died at Rome in 1670.

(Tiraboschi, *Storia della Letteratura Italiana.*)

UGOTZ is a small county in the kingdom of Hungary, in the circle beyond the Theiss. It is bounded on the north and west by the county of Beregh, and on the east and south by that of Szathmar. The area is only about 486 square miles, and the population (in 1832) 40,643, of whom two-fifths are Hungarians, the remainder Wallachians and Rusniaks. In the northern and eastern parts there are some mountains. The southern part is a plain, with a very slight declivity, on which account the Theiss flows very slowly and with many windings, and forms numerous islands: there are also extensive marshes, and the frequent inundations are injurious to the productiveness of the soil: in dry seasons it is more fruitful. The mountainous part is sterile. Of the productive part of the land (166,384 acres), above one-half is covered with forests, 60,000 are arable, 8327 meadows, and 1318 vineyards. The chief domestic animals are swine, which feed in the great oak-forests. There is a pretty considerable number of sheep, and no want of horned cattle. The principal productions are timber, corn of all kinds, hemp, flax, tobacco, and fruit. In the woods there are bears, lynxes, stags, fallow-deer, and a variety of birds. Fish are extremely abundant, especially in the Theiss, and are a chief source of wealth to the inhabitants. There is no considerable town in this county. Nagy Szollos, the capital, has only 2500 inhabitants.

(*Oesterreichische National Encyclopädie; Ungarn, Croatien, Slavonien, und der Ungarische Militair Gränze*, Leipzig, 1834, anonymous.)

UIST, the name of two of the larger Hebrides [HEBRIDES], belonging to Inverness-shire [INVERNESS-SHIRE], and distinguished as North Uist and South Uist. North Uist is separated on the north from the southern extremity of Long Island by the Sound of Harris, in which are a number of smaller islands; and on the south from the island of Benbecula by a narrow strait without name, dry at low-water. South Uist lies south of Benbecula, from which it is separated by a narrow strait, and at its other (southern) extremity is separated by a strait from the little island of Barra. Both North and South Uist are separated on the east from the Isle of Skye by the channel of the Little Much, here about 15 miles across at the narrowest part, and on the west they are washed by the expanse of the Atlantic. They lie between 57° 5′ and 57° 45′ N. lat. and between 7° 6′ and 7° 30′ W. long.

North Uist is about 16 miles long from east to west, and about 13 wide from north to south, measured in a direct line: but the island is so intersected by deep arms and inlets of the sea, and so occupied by freshwater lakes, that it can hardly be crossed in any direction without making a circuit. The erection of wooden bridges over some of the inlets has diminished this inconvenience. Some of the inlets of the sea on the east side, especially Loch Maddy, form commodious harbours. There are hills on this side of the island from 300 to 700 feet high; Mount Eval, near the south-east corner of the island, is above 2000 feet. More to the west are barren moors, then other hills covered with heath and rough pasture; then on the west side of the island lie the principal pasture and cultivated lands, with a shore generally low, but having a few bold rocky headlands. The tillage land yields good crops of bear or barley; the pasturage is covered with white and red clover. The sands on the west coast are composed of fragments of shells ground to powder, and being carried inland by the wind, they form a calcareous manure and tend to improve the land. The island is chiefly formed of gneiss: but at the entrance of Loch Maddy are two basaltic rocks rising out of the sea.

Aquatic birds are numerous on the freshwater lakes, in which trout are found. Some of the islands in these lakes contain red deer. Fish are not very numerous on the coast, except shell fish, especially cockles, which are abundant. The otter and the seal are found on the shore.

The whole island belongs to Lord Macdonald: it contained, in 1831, 797 inhabited houses; 833 families, of which 602 were employed in agriculture and 69 in manu facture, trade, and handicraft; the population was 4603. The quantity of land in tillage was 11,200 acres, Scotch measure; the quantity of constant pasture was 42,350 acres. Some of the 'tacksmen,' or larger farmers, who hold leases, are skilful agriculturists: the smaller tenants have improved within the last 30 years. Fishing is little attended to; and the manufacture of kelp, though still carried on, has much declined. Eleven decked vessels, from 20 to 60 tons each, belong to the island: one is a packet, the rest are employed in local trade. Peat is abundant, and is the common fuel. The people speak Gaelic, but above a fifth of the adults understand and speak English. They are a sober, industrious, and cleanly people.

There are a parish church, a government church finished in 1828; thirteen schools, one parochial, ten supported by different societies, and two private schools. There are libraries attached to two schools. There is a sub-post-office to Dunvegan in Skye, and there are four inns. There is no market, but two yearly fairs are held for black cattle and horses. There are several antiquities, as upright stones, rude crosses, and cairns; 'duns,' or Danish forts, and subterranean retreats called 'Uaighs,' or 'Picts' houses.'

The parish of North Uist comprehends also the small circumjacent islands of Orinsay, Boveray or Borera, or Boreray Vallay, Heisker or Hysker, Ronay, and others. Some of these are united to North Uist at low-water.

South Uist is about 22 miles long from north to south, and about 8 broad from east to west. The eastern side is rugged and mountainous: Heacle-Heacam-hill, or Hecla, the highest mountain in the island, is 2500 feet high; other mountains are from 1200 to 1300 feet high. The eastern coast is bold and irregular in its outline; its three principal inlets, lochs Skipport, Eynort, and Boisdale, are good harbours: the western coast has a more regular outline, and has, except about some rocky headlands, a low sandy shore. There are numbers of lakes; the largest is Loch-Bee, in the north of the island, into which the sea at spring-tides enters.

The island of Benbecula and a number of smaller islands belong to the parish of South Uist. Benbecula is about 8 miles long from east to west, and 7 from north to south. Its general character and appearance are similar to those of North and South Uist; it is marked by a bold coast and deep inlets on the east, and a low coast on the west, with a number of lakes. The area of the parish is 80,508 acres, or about 120 square miles.

The islands of South Uist and Benbecula are formed of gneiss, coarse granite, and hornblende; mica-slate is seen in a few places.

The three landowners of the parish were all of the Macdonald family, but the principal estate has lately been sold. There are about 19,000 acres of arable-land. Cultivation has been extending and improving. The chief articles produced are potatoes, bear, and oats; a little rye and a few turnips are grown. Attention is paid to rearing cattle. Kelp is manufactured; but there is but little fishing, and the island has only four decked vessels, and those of small burden.

There were, in 1831, 1298 inhabited houses; 1298 families, of whom 1206 were employed in agriculture, and only 3 in trade, manufactures, and handicraft; the population was 6890. The people speak Gaelic, and though generally well behaved, are not cleanly in their habits: the extreme poverty of some leads to petty thefts. There is no parish church, but there are two churches or chapels to missionary districts, and three chapels for the Roman Catholics, who form two-thirds of the population. There are ten schools, the parochial school and nine others, most of them connected with charitable societies. There are four mills in the parish and four inns. There are some remains of one or two towers and some relics of a monastery, chiefly in Benbecula.

(*Map of Scotland*, published by the Society for the Diffusion of Useful Knowledge; *New Statistical Account of Scotland*; MacCulloch's *Highlands and Western Isles of Scotland*.)

UKRAINE is a name probably derived from the Polish, in which it signifies boundary, a term which has been in general use since the conquest of Kiew by the Lithuanians, and at that time designated the frontier towards the Tartars and other nomade tribes. Subsequently the name Ukraine was applied to the extensive and fertile tract of land on the banks of the Dnieper, together with the territory of the Cossacks, with rather indefinite boundaries. These countries, which till the time of Peter the Great were a constant source of quarrels between Russia and Poland, constitute the greater part of Little Russia, that is, the four governments of Kiew, Podolia, Poltawa, and Slobodsk Ukraine. This tract is remarkable for its rich pastures, and a fine breed of horses and horned cattle. The face of the country, the soil, natural productions, and other particulars are described in the articles on the four governments. [KIEW; PODOLIA; POLTAWA; SLOBODE UKRAINE.]

(Brockhaus, *Conversations Lexicon*; Hassel, *Handbuch*; Cannabich, *Lehrbuch*; Schmidtlin, *La Russie, la Pologne, et la Finlande*.)

ULCER. [INFLAMMATION.]

ULEABORG. [FINLAND.]

ULEMA ('Ulemá), the collective name of the body of learned men in Turkey, is the plural of the Arabic ''Alím,' 'wise,' and signifies originally 'the wise men.' The learned men in Turkey form a corporation which received its organization from Mahmud-Pasha, grand-vizír of Mohammed II., the conqueror of Constantinople. In the larger meaning, the word ulema comprehends all the divines, the jurists, and even the priests (the imáms, the sheikhs, the moezzíns, the khátibs, and the kaïms), as well as the monks. But ulema, in its meaning as an organized body, comprehends only professors of divinity, of law, and of some other sciences, any one of which is easily connected with divinity and law, on account of the Korán being the source of all science. The mufti is the president of the ulema, which has great political influence. No one can become a 'muderri' (professor) or 'kadi' (judge) except a member of the ulema, nor can any one be appointed chief judge or mufti without having previously occupied a subordinate place as judge or professor. An individual belonging to the ulema is called by the general name 'mollah,' or 'a man of the law.' In important cases, the mufti assembles the ulema, or as many of them as he judges convenient, and takes their opinion on the subject.

(D'Ohsson, *Tableau de l'Empire Ottoman*; Hammer, *Des Osmanischen Reiches Staatsverfassung und Staatsverwaltung*.)

ULEX, a genus of plants belonging to the section Loteæ, of the natural order Leguminosæ. The species of this genus are branched evergreen shrubs, furnished with spines, and bearing yellow flowers. The calyx is 2-parted and 5-toothed; the legume oval-oblong, turgid, scarcely longer than the calyx, containing but few seeds; ovules numerous.

Ulex Europæus has linear lanceolate leaves, villous branchlets, ovate loose bracteas, and a pubescent calyx. This is the common furze, gorse, or whin, and is a common inhabitant of the plains and hills of Great Britain. It is an erect evergreen shrub, with beautiful yellow flowers, which appear in greatest abundance from February to May, although in mild seasons it may be seen in blossom all the year round, giving rise to the old proverb that 'Love is out of season when the furze is out of blossom.' When it grows in cold, elevated, and open situations, it seldom attains a height of more than two or three feet, but in sheltered woods and other favourable spots, it reaches a height of from ten to eighteen feet. This plant, although hardy in its native districts, has only a limited geographical range. Great Britain is the centre of this range. It is not found so far north as Sweden or Russia, nor farther south than Provence. In Great Britain it does not grow at a greater height than 1500 feet. Linnæus laments that he could scarcely keep the furze alive in his greenhouse at Upsal. The furze, though generally an indication of the want of cultivation, is not without its uses. It makes an excellent fodder for cattle and horses, of which they are exceedingly fond. The mode of using it for this purpose is to grind the shoots and young branches in a bark or cider mill. In some places the growth of furze is made a regular part of farm management, the plants being cultivated in rotation with corn and other crops, and are either mown twice in four years, or three times in six years, and the ground is again broken for corn. The furze is sometimes used for hedges, for which it is well adapted, especially where the hawthorn or holly will not thrive. The hedges should be made wide, and regularly clipped, which may be used to advantage where cattle or horses are kept. Where ornamental hedges are made of furze, the double variety should be employed on account of its handsome flowers. Furze is a useful plant as a shelter in plantations where young trees are sown, as the oak, beech, &c. When the trees are grown strong enough, the furze may be removed, and it will have served as a cover for game in the mean time. This plan has been adopted by the government in the New Forest and the Forest of Dean. Where furze is abundant it is burnt for the sake of the ashes, which make an excellent manure. The ashes contain a large proportion of the salts of potassa, and are used in many parts of the country as a lye for washing. The seeds, like most of the Leguminosæ, contain a large quantity of nutritive matter. The double-flowered variety of Ulex Europæus was first found in Devonshire, and is now not uncommon in gardens and shrubberies. The double flowers add very much to the beauty of the plant. It can only be propagated by cuttings.

U. nanus, the Dwarf Furze, has the teeth of the calyx lanceolate, spreading; the bracteas minute, close, pressed; the leaves linear and smooth; the branches smooth, reclining. This plant is a native of Britain, also of the west of France, in poor gravelly soils, but not common on the Continent. It is also found in Ireland. It grows at a greater elevation than the last species by 200 or 300 feet. It flowers from the end of August till the beginning of December, and not at other seasons. It may be at once distinguished from the last, by its smaller and more delicate structure and reclining habit. It seldom attains a height of more than two feet.

U. strictus, the Irish Furze, has few or no spines, with an erect, narrow, and compact habit. This plant was discovered in the county of Down in the Marquis of Londonderry's park. It is an upright plant, seldom flowering; its branches are soft and succulent; and in size and character it stands between the two foregoing species. This plant has never yet produced seeds, so that it requires to be propagated by cuttings; and from this and its want of more definite structural characters, it has been supposed to be only a variety of one of the former species. Its soft succulent character renders it much more fit for a forage-plant than the common furze, and it has been used for this purpose with great success in different parts of Wales. It requires no grinding or previous preparation to its being used as fodder. There is yet another species, *U. provincialis*, the Provence furze. It has a pubescent calyx, with distant, lanceolate teeth. There are considerable doubts as to whether this is anything more than a variety; as such however it deserves attention in cultivation.

In the cultivation of the furzes little care is required in this country. When grown in open fields, the seed may be sown broad-cast, and the young plants for the first year or two should be kept free from weeds. They will not flourish on wet or clayey soils, but prefer those which are dry, rocky, and gravelly. The common furze is sometimes killed down by severe winters, but it springs up again at the approach of spring.

(Loudon, *Arb. et Frut. Brit.*; *Cyclopædia of Plants*; Hooker, *British Flora*; Burnett, *Outlines of Botany*.)

ULIETEA. [SOCIETY ISLANDS.]

ULLAGE, a name given by gaugers to the part of a cask which is not filled with liquor: thus, if a cask, capable of holding 90 gallons, have only 80 gallons of spirits in it, there are 10 gallons of ullage.

ULLESWATER. [WESTMORLAND.]

ULLMANNITE. *Phosphate of Iron and Manganese.* [MANGANESE, *Ores of.*]

ULLOA, ANTONIO DE, was born in Seville on the 12th of January, 1716. He was educated for the naval service, in which more than one member of the family from which he sprung had distinguished themselves. He was admitted in 1733 into the company of royal marine guards. In 1735 he was selected in consequence of the distinguished progress he had made in mathematics and in the theory of his profession, along with Jorge Juan, to accompany the French Academicians to South America, to measure a degree of the meridian at the equator. Both the young mariners (Ulloa was at this time only in his twentieth and Juan in his twenty-third year) were promoted to the rank of lieutenant in the navy on receiving this appointment.

The squadron in which Ulloa and his companion embarked sailed from Cadiz in May, 1735, and landed them at Carthagena on the 9th of July. They did not return to Spain till the year 1746. The whole of the intervening period was not however devoted to scientific measurements. They were detained five months at Carthagena waiting for the French corvette which carried the Academicians, and this time was spent by Ulloa in studying the natural history of the district. The geodetical operations commenced in the neighbourhood of Quito, in June, 1736, and the exertions of Ulloa to advance them were strenuous and indefatigable, till towards the close of September, 1740, when Juan and he were summoned to Lima by the Viceroy to assist in placing the coasts in a state of defence against the expected arrival of the English squadron under Anson. As soon as the necessary arrangements were made they returned to the scene of their labours, which were almost immediately interrupted by a summons to Guayaquil, where the sack of Payta by the English had spread universal terror. After the necessary measures for the security of the province had been adopted, the terrified inhabitants insisted upon one of the officers being left to superintend their execution. Ulloa returned to Quito without his companion, and had scarcely reached it when he was recalled to Lima. Two frigates were placed under the command of himself and Juan, with orders to cruise along the coast of Chili and off Juan Fernandez. At last the arrival of reinforcements from Spain set them finally at liberty. On returning to Quito, however, they found the Academicians had departed, with the exception of Godin, along with whom they observed the comet of 1744. Ulloa and Juan embarked in October of that year on board two French vessels to return to Europe. The which carried Ulloa sought refuge from an English privateer in the harbour of Louisbourg in Cape Breton, but by the time it entered, the town had fallen into the hands of the English, and all on board were made prisoners of war. Ulloa was conveyed to London, where he was received with marks of distinction, made a member of the Royal Society, and by the intercession of his scientific friends set at liberty. He arrived at Madrid, in July, 1746, after an absence of eleven years and two months from his native country.

Ulloa's reception at court was flattering; he was appointed to the command of a frigate, and created a commander of the order of Santiago. The task of publishing the scientific observations devolved upon Jorge Juan; to write the history of the expedition was the charge of Ulloa. Two years were consumed in preparing the narrative for publication: it appeared in 1748. The work was comprised in four volumes: the first relates the adventures of the expedition from the time of its departure from Cadiz till the conclusion of the geodetical measurements; the second contains a description of the province of Quito in one book; the third, the narrative of Ulloa's and Jorge Juan's journeys to Lima and cruise along the coasts of Chili while a descent on the part of Anson was apprehended; the fourth, the return voyage from Callao to Europe, and an appendix containing a chronological account of the rulers of Peru, from Manco Capac to Ferdinand VI. The work shows that the necessity of the case, as well as personal tastes, had contributed to devolve the account of the strictly scientific operations of the expedition upon Jorge Juan. Ulloa had more taste for knowledge than talent for strict scientific inquiry. His activity and inventive genius, fruitful in resources, had materially promoted the labours of the expedition, and he had that passion for knowledge which enables its possessor to give an impetus to discovery. But for the additions made to strict science by the Spanish members of the expedition the world is beholden to Jorge Juan. Ulloa's work however, though deficient in method and accuracy, is amusing and suggestive of thought. He and Jorge Juan in the character of their intellects stood in somewhat the same relation to each other as La Condamine did to Bouguer, but to the honour of the Spaniards, no paltry jealousy occasioned unseemly quarrels between them, such as detracted from the merits of the Academicians, and their harmonious co-operation enabled them to get the start of their French associates in publishing the results of their labours. Don David Barry published, in 1826, a volume which professes to contain the 'Secret Report,' made by Juan and Ulloa to the minister Ensenada, of the condition of Spanish America: it could have been wished that the editor had given some account of the history of the MS. and the manner in which it came into his hands.

Ulloa subsequently made tours of observation, by order of the Spanish government, in several countries of Europe. During the reign of Ferdinand VI., however, he appears to have been kept in the background. Upon the accession of Charles III. innovation became for a time fashionable at court, and the inquiring and enterprising spirit of Ulloa found itself in a more congenial element. After Louisiana was ceded to the crown of Spain, in consequence of the peace of 1762, he was nominated to take possession of and to organise the province. He arrived at Louisiana in 1766, but his attempt to play the part of governor was an entire failure; it was necessary to supersede him by the appointment of O'Reilly. Ulloa after his return to Europe published (in 1772) a volume of essays on the natural history and antiquities of America. They bear, even more strongly than his narrative of the expedition to South America, the impress of a dilettante spirit of inquiry. In 1778 he published a memoir entitled 'The Marine; or the Naval Forces of Europe and Africa,' a work which we have not met with. In 1778 he published, at Cadiz, 'Observations of a Solar Eclipse, made at Sea.'

In 1779, having by this time risen to the rank of lieutenant-general in the naval service, he was placed in command of a squadron fitted out to intercept and capture an English merchant fleet off the Azores, and then to repair to Havannah, to join a larger force destined to make a descent on Florida. Wholly engrossed by his speculative inquiries, Ulloa forgot to open his sealed despatches, and returned to port after an unsuccessful cruise of two months. He was arrested, tried by a court-martial in 1780, allowed to retain his rank and titles, but never again employed on active service. He even retained his place in the ministry of the marine, but was only employed in examining the pupils of the school of naval artillery.

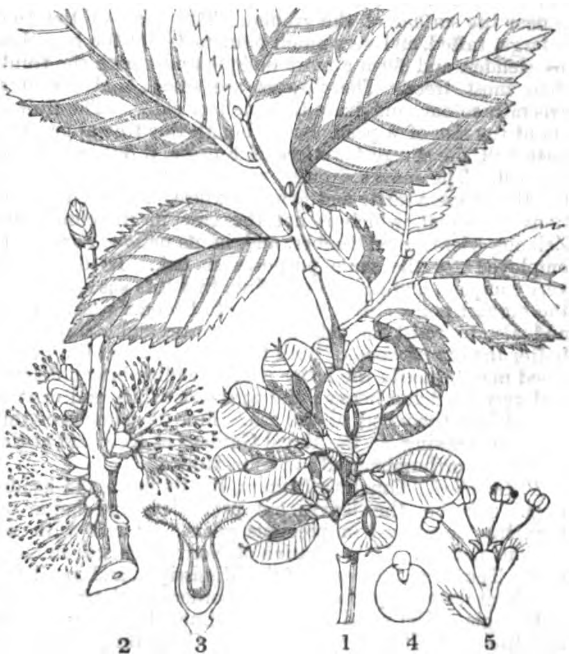
Ulloa died in the Isla da Leon, on the 3rd of July, 1795. He retained his constitutional gaiety and activity to the last. Visitors found him surrounded with papers, antiquities, mathematical instruments, crucibles, in short all the nicknacks of science. But if not himself a great philosopher, Ulloa aided materially in promoting that temporary re-awaking of the intellectual activity of Spain, which characterised the second half of last century. He contributed greatly to the establishment of the observatory at Cadiz. Spain is indebted to him for its first cabinet of natural history, and its first laboratory of experimental metallurgy. He was a munificent patron of the arts of printing and engraving. He superintended the construction of the maps of the Peninsula. He originated the canal of navigation and irrigation of Old Castile, commenced under Charles III., and abandoned by his successors. Ulloa superintended the establishment of a cloth manufactory at the expense of the government, at Segovia, which was intended to set the example of improving the domestic manufactures of Spain; and upon his urgent representations young Spaniards were sent to acquire the liberal and mechanical arts in various countries of Europe.

(The materials for this sketch have been found in the writings of Ulloa, and in his biography by Messrs. Audeffret and Viguier, in the *Biographie Universelle*.)

ULM, the capital of the circle of the Danube, in the kingdom of Würtemberg, is in 48° 24′ N. lat. and 10° E. long. It is situated in a beautiful and fertile country at the south-eastern foot of the Swabian Alps, on the left bank of the Danube, which here forms the boundary between Würtemberg and Bavaria, and is joined by the Blau, which flows through the town. By the junction of this river and of the Iller, which falls into it on the right bank a few miles above Ulm, the Danube becomes navigable, being about 200 feet broad and 12 feet deep. The city is nearly of an elliptical shape, and the ground on which it stands is tolerably level. Previously to the year 1805, it was strongly fortified, but the works have been nearly demolished. Like most of the old German towns, it has in general irregular and crooked streets, and antique-looking wooden-houses; there are however some broad handsome streets, with flag-pavement for foot-passengers. Within the city there are three stone and two wooden bridges, over the Blau; but the handsomest is a stone bridge of three arches over the Danube, which connects the town with the Bavarian village of New Ulm, on the right bank of the Danube, and was erected in 1832, at the joint expense of the crowns of Würtemberg and Bavaria. Ulm has many buildings worthy of notice. The Minster, a very fine specimen of antient Gothic architecture, and one of the largest and loftiest churches in Germany, is 485 feet long, including the choir, 200 feet broad, and the middle aisle 150 feet high. The steeple is 337 feet high, and, though not completed, is a splendid monument of German art in the middle ages. This Minster was 111 years in building (1377-1488). It contains many curious monuments and works of art; paintings by old German masters, admirable carved-work, painted-glass windows, and a remarkably fine organ. The town-house is a very antient and spacious edifice, not remarkable for its architecture, but it contains many fine paintings, among which is a portrait of Gustavus Adolphus, king of Sweden, and in the vaults underneath are the archives, with many valuable historical documents. The German-house (das Deutsche-haus), containing the principal public offices, is considered the handsomest and most regular building in the city. The theatre is adorned externally with Corinthian columns. Besides the Minster there are two Lutheran and two Roman Catholic churches. There are in Ulm a gymnasium, a museum, a city library, a large and rich hospital, and numerous charitable and useful institutions. The city has now 16,000 inhabitants, who manufacture linen, silks, snuffs, tobacco, tobacco-pipes, porcelain, &c. This city has a very considerable trade; great quantities of manufactured goods and of the productions of the country are sent down the Danube in barges built at Ulm, which do not come back, but are sold at Vienna. Being placed in an important military position on the Danube, Ulm is well known in the history of the wars in Germany. In 1805, after the victories of the French at Elchingen, on the 14th and 15th of October, it capitulated on the 17th to Napoleon, General Mack and the Austrian garrison of 28,000 men being made prisoners of war.

(Brockhaus, *Conversations Lexicon*; A. Fischer, *Das Königreich Würtemberg*; Stein, *Geographisches Lexicon*; Cannabich, *Handbuch der Geographie*.)

ULMA'CEÆ, a natural order of plants belonging to Lindley's rectembryose group of incomplete Exogens. The essential characters of this order are as follow:—Flowers hermaphrodite or polygamous, never in catkins; calyx divided, campanulate, inferior, irregular; stamens definite, inserted into the base of the calyx, erect in æstivation; ovary superior, 2-celled; ovules solitary, pendulous; stigmas two, distinct; fruit 1-2-celled, indehiscent, membranous or drupaceous; seed solitary, pendulous; albumen none, or in very small quantity; embryo straight or curved, with foliaceous cotyledons and superior radicle. (Lindley.) This order consists of trees or shrubs, which have scabrous, alternate, simple, deciduous leaves and stipules. The genera belonging to it are Planera, Abelicea, Ulmus,



Ulmus campestris.

1, Branch with leaves and fruit; 2, branch with flowers before leaves are expanded; 3, ovary and stigmas; 4, embryo; 5, single flower separated.

Celtis, Sponia, Mertensia. The species are natives of the north of Asia, the mountains of India, of North America, China, and Europe. This order is by most botanists made a section of the natural order Urticaceæ. It was however separated by Mirbel, and he has been followed by Lindley. They differ from Urticaceæ in the possession of a 2-celled fruit and hermaphrodite flowers. In all other respects they resemble Urticaceæ, and their affinities are the same. [URTICACEÆ.]

Most of the species of this order are trees, the timber of which is often very valuable. The bark of the Elm is used in medicine. [ULMUS.] A proximate principle called Ulmin has been obtained from the Elm, but the other genera of the order have not yet been examined.

The genera *Planera* and *Celtis*, like the elm, have species which are handsome ornamental trees, and yield useful timber. The genus *Planera* is known by being polygamous, the flowers being hermaphrodite and single on the same plant. The pistiliferous and hermaphrodite flowers have a bell-shaped calyx distinct from the ovary, green, of one piece, and furnished with 5 ciliate lobes. The stamens of the hermaphrodite flowers are four or five in number, and less developed than those of the flowers which bear stamens alone. The ovary is villous, with 2 sessile, diverging, white, pimpled stigmas. The fruit is roundish, 2-celled, each cell containing one seed. The staminiferous flowers have a similar calyx to the others, and the stamens are inserted opposites its lobes. Anthers of two lobes, which have the appearance of four. The species of this genus are trees inhabitants of Asia and North America. They are quite hardy, and will grow in the climate of Great Britain. The leaves are alternate, and the flowers are small.

Planera Richardi has its flowers solitary in the axils of its leaves, and both are borne on a branch developed in the same year with themselves; the petiole of the leaf is not obvious, and the disk is elliptical, unequal at the base, and dentate. This tree is the Zelkoua of Siberia, and is native of the country between the Black and Caspian seas, between the latitudes 35° and 47°. It was introduced into Europe about the year 1760, when a specimen of it was planted by Lemonnier, professor of botany in the Jardin des Plantes, in his garden at Montreuil near Versailles. This tree was cut down in 1820, and it was found to be 70 feet in height, and the trunk was 7 feet in circumference at 5 feet from the ground. In its native districts the Zelkoua attains a height of from 50 to 80 feet. The trunk is straight and very upright, and in large trees it often measures 30 or 40 feet from the ground to the point where it throws off its branches. A remarkable character of the trunk of this tree is that it is as thick at the point of ramification as it is near the surface of the ground. The head of the tree is large, tufted, and very much branched, and the branches are slender, and form a more oblique angle with the trunk than most trees. The flowers are small, and are of a greenish colour, and have the smell of elder. The fruit is about the size of a pea; but although this tree appears to bear well the severest winters of Europe, it does not ripen its seed. The leaves strongly resemble those of the elm, but they have a drier and firmer texture, and their crenations are equal, which is not the case in the elm. The Zelkoua yields good timber, and in its native countries is employed for the same purposes as oak. Its texture is very compact, and the grain so fine, that it is susceptible of the highest polish. It is said never to become worm-eaten, and also to resist the influence of water and damp earth better than most woods. Both the sap-wood and the heartwood may be used: the latter is of a reddish-brown colour, and very hard and heavy; the former is white and elastic, resembling the wood of the ash. Fine specimens of this tree are growing at the Royal Gardens at Kew and at the Duke of Northumberland's at Sion-House.

P. Gmelini. Gmelin's Planera, has its flowers in heads, opening before the leaves are protruded, and borne on branches developed in previous years; its leaf with an obvious petiole. It is a native of North America, in Kentucky, Tenessee, the banks of the Mississippi, and in all the Southern states, especially on the borders of the Savannah in Georgia. The wood is hard and strong, but it appears to be little used. It was introduced into Great Britain in 1816.

The species of Planera may be propagated by grafting on the common elm, or by seeds when obtained from the native forests of the plants.

The genus *Celtis* has the following characters: the flowers are borne upon the shoots of the year, in the axils of the leaves, either solitary or 2 or 3 together, and each upon a peduncle; the calyx is well-shaped, distinct from ovary, 5-6-parted, imbricate in æstivation; 5 or 6 stamens inserted into the base of the calyx, opposite to the lobes and shorter; anthers 2-celled, opening at the sides; ovary ovate, 1-celled; stigmas 2, sessile, acuminate, long, spreading or recurved, downy or glandular; fruit a drupe: seed solitary, pendulous. Upwards of 19 species of this genus have been enumerated. They are handsome, branched, deciduous trees, varying in size and the character of their foliage, and bearing a fruit which is edible. The leaves are alternate, in two ranks, ovate, and pointed; and all drop off the tree about the same time. They are natives of the temperate parts of Europe, Asia, Africa, and America.

Celtis Australis, the European Nettle-tree, has ovate-lanceolate leaves, serrated, unequal at the base, rough on the upper surface, soft from down on the under one; the flowers are solitary; fruit black. It is a tree growing to the height of 40 feet, and is indigenous to the south of Europe and the north of Africa. It has a straight trunk and a branched head. The fruit, when ripe, is blackish, about the size of the fruit of the bird-cherry, and its edible qualities are much improved after a frost. This fruit is sweet, and is supposed to be the Lotus of the antients, and the food of the Lotophagi. The flavour of these berries however will hardly justify the character given of them in the 'Odyssey,' lib ix., ver. 93, in which they are said to make those who eat them forget their country. The Spaniards eat these berries, and the modern Greeks are said to be fond of them. Dr. Sibthorpe says that in Greece they are called at the present day honey-berries. The wood of this tree is highly prized. It has a character between the oak and the box. A cubic foot weighs 70 lbs. 3 oz. It is very elastic, and a piece 6 feet long may be bent into a circle without breaking. It is used for making furniture, also by carvers for making images; but the great use of this tree is for making pitchforks. For this purpose large plantations are cultivated in the south of France. The young vigorous shoots are used for making handles to coachwhips, ramrods for guns, and walking-sticks. In Narbonne the tree is cultivated for this purpose, and, under the name of *Bois de Perpignan*, is used extensively throughout Europe for the above purposes. The root also of this tree is used for dyeing yellow; the bark contains an astringent principle which renders it useful in dyeing; and an oil is expressed from the seeds. Although in many respects a valuable tree, it has been but little cultivated in Great Britain. Specimens at Mitcham, Kew, and Ken Wood, Highgate, have attained a height of 40 feet.

C. occidentalis, the North American Nettle-tree, has ovate-acuminate leaves, unequal at the base, serrated, rough on the upper surface, hairy on the under one; fruit dark red or purple. This is an American species, and is found in woods and near rivers from Canada to the Carolinas. This species was introduced into Europe as early as 1656. It has a very great resemblance to the last species. It is however readily known by its leaves being larger, and of a lighter and more shining green. The fruit, like that of the last species, is edible, but not very grateful to the British palate. It is a very ornamental tree, and many fine specimens of it are existing in this country; but neither in this country nor in America does the timber appear to be used, although, from its resemblance to the European species, there can be little doubt of its value.

C. crassifolia, the Huckberry, has ovate-acuminate leaves, 6 inches long and 3 or 4 inches broad, heart-shaped, and unequal at the base, serrated and rough on both surfaces; flowers one or two upon the peduncle; fruit black. This is another North American species, and is closely allied to the last, and some botanists even think them identical. It is a native of the banks of rivers and fertile valleys in Kentucky and Tenessee. It sometimes, in its native forests, is found 80 feet high, but having a trunk not more than 18 or 20 inches in diameter. The leaves are much larger and broader than any other species of nettle-tree. The flowers are small and white, and the fruit is about the size of a pea. It grows very rapidly, and, on account of its large leaves and numerous branches, is well adapted for ornamental planting. The wood is not of much value, on account of the small size of the trunk; but in America it is used for making the bottoms of chairs, and also for baskets. There are several of the other species of Celtis that might probably form useful trees were they introduced into Europe. Some of the East Indian species occur at elevations that render it probable they might be successfully cultivated in this country.

(Loudon, *Arboretum et Fruticetum Britannicum ;* Lindley, *Natural System.*)

ULMIC ACID, or ULMIN. Some trees, and more especially the elm, when it is old, secrete a liquid which dries as it exudes: the residue consists principally of mucilaginous matter, with some carbonate or acetate of potash, and eventually the mucilaginous matter undergoes a change, and, combining with the potash, forms a substance which was first examined by Vauquelin and Klaproth, and Dr. Thomson gave it the name of *ulmin.* This name was changed by Berzelius to that of *geic* acid, because on treating soils with alkalis a considerable quantity of a similar compound is obtained.

Ulmin, or ulmic acid, may be artificially obtained, according to Braconnot, by the following process:—heat in a silver crucible equal weights of potash and sawdust, with a little water; the mixture is to be continually stirred: the mass softens and swells rapidly, and is then to be removed from the heat and stirred till cold: during the operation oxygen is absorbed from the air, owing to which the ulmic acid is formed. When cold, the product, which contains ulmate of potash, is dissolved in water, filtered, and treated with dilute sulphuric acid, which combines with the potash, and precipitates the ulmic acid from combination with it: the acid thus obtained is to be washed and dried. The properties of this ulmic acid are, that it is of a deep brown colour, very brittle, and breaks in angular fragments, and is almost insoluble in water. When precipitated from its solution in an alkali, it is in the state of hydrate, and it then dissolves in 1500 times its weight of boiling water, in 2500 times between 60° and 70° Fahr., and in 6000 times at 32°. The solution in cold water is brownish-yellow; that in hot is deep brown.

It is insoluble in acidulated water or in saline solutions: sulphuric acid dissolves it without apparent alteration, and becomes blackish: water precipitates it from this solution. Ulmic acid reddens tincture of litmus. It is dissolved by alcohol, from which it separates in crystalline scales by spontaneous evaporation.

It has been already mentioned that ulmic acid may be obtained from soils: it may also be procured from rotten leaves, bog-earth, wood-soot, or turf, by digesting them in a weak solution of potash: by this a brown-coloured solution of ulmate of potash is formed, from which acids throw down ulmic acid.

According to Boullay, ulmin consists of—

Hydrogen . . .	4·70
Carbon	57·64
Oxygen	37·66
	100·

Malaguti and Boullay, by treating sugar with dilute sulphuric acid, obtained two substances, which they supposed to be identical with ulmin and ulmic acid; but, according to Liebig, they are of a different nature, and he has given them the names of *sacchulmin* and *sacchulmic acid.*

Ulmic acid plays an important part in manures and soils, and what is called *moss-water* owes its peculiar properties to its presence: it probably acts as a powerful manure, especially when combined with lime or with ammonia.

ULMUS, a genus of plants, the type of the natural order Ulmaceæ.

Description of the Genus Ulmus.—All the species of the genus are trees, some of them attaining a great size and age. The flowers are small and the leaves are alternate. In most of the species the flowers appear earlier than the leaves; they are disposed in groups and seated on short peduncles. The calyx is of a reddish colour, distinct from the ovary, imbricated in æstivation, with from 4 to 8 segments, which remain until the fruit falls. The stamens are as numerous as the segments, and are inserted opposite to them. The ovary is elliptical, compressed, cloven at the summit, 2-celled, and 1 ovule in each cell. The fruit is a samara, the wing-like appendage being broad and present all round, except in a notch. Only one of the cells of the ovary develops its seed, so that the fruit is one-seeded. The embryo has no albumen, and its radicle is straight and uppermost. The leaves are stalked and unequal at the base, serrated, and generally rough to the touch; the axils of the primary nerves beneath are tufted with fine hairy filaments. The various species of elm are wild in Europe, North America, India, and China. Nearly 20 species have been enumerated by various writers, but it is not at all certain that these are true species. This uncertainty arises from the fact which is now generally recognised by the cultivators of the elm, that the seeds of the elm do not produce plants precisely like their parents, and that the amount of difference in the elm is greater than amongst most other species of trees. It is on this account that there are so many recorded varieties of the species which are cultivated for ornament or timber. Linnæus referred all the species of Ulmus to his *U. campestris.* Sir J. E. Smith admitted 5 species of British elms alone, and Dr. Lindley, in his 'Synopsis of the British Flora,' has admitted 7 species. Other writers, as Loudon, in the 'Arboretum et Fruticetum Britannicum,' and Selby, in the 'History of British Forest-Trees,' are inclined to reduce all the British species to two types, the *Ulmus campestris* and *U. montana.* Koch, in 'Flora Germanica,' admits but two species, *U. campestris* and *U. effusa.* To the former he refers all the British species. With regard to the extra-European species, the difficulty of recognising them is still greater, and probably some that have been named as distinct species, growing in India, China, &c. are only varieties of *U. campestris* or *U. montana.* This is one of the genera of plants that would repay careful revision; but all observations must be made on living plants, and through a period of several successive years. The elms, whatever may be their species, have been since the time of the Romans the most commonly cultivated timber-trees of Europe. The reason of this is found in its comparatively easy cultivation, the rapidity of its growth, and the readiness with which it grows in almost any soil or situation. It also bears transplantation well, and almost at any age. It has however its disadvantages: the timber is very apt to shrink or warp, unless it be kept constantly moist or has been cut down many years before it is used. It is also during its growth very liable to the attacks of insects, which prove entirely destructive to its timber. The elm, like the beech and some other trees, is very liable to form knobs or knots under its bark, but they are seldom single knobs as in the beech, but compound, the layers of wood of which they are formed being developed round several central points. These knobs have been called embryo-buds and abortive branches. [TISSUES, VEGETABLE.] When these compressed knots are cut through, they present a very beautiful appearance, and are often used by cabinet-makers for ornamental work. In describing the species of elm, we shall follow the selection adopted by Loudon, in his 'Arboretum et Fruticetum Britannicum.'

Description, Uses, &c. of the Species of Elm.—*Ulmus campestris*, the common English or Small-leaved Elm, has leaves doubly serrated, rough; the flowers nearly sessile, 4-cleft; the fruit oblong, deeply cloven, glabrous. This tree is a native of the middle and south of Europe, the west of Asia, and Barbary. It is also found abundantly in France, Spain, and Italy. Although it is called the English elm, a question has been raised as to whether it is a native of Britain; and some have supposed, on account of its not ripening its seeds in this climate, that it is an introduced plant, and that it was probably brought over by the Romans; whilst others have supposed it was brought from Palestine during the Crusades. There is no evidence to decide the question, but the tree is at any rate now perfectly naturalized in this country. It is seen in its greatest perfection and beauty in the southern and middle parts of England, where it has been extensively employed for forming avenues for public walks and drives in the vicinity of towns, and is planted extensively in the parks and around the mansions of the wealthier classes of the community, and is the prevailing hedgerow-timber of these districts. This tree grows rapidly, and often obtains a height of from 70 to 90 feet, with a trunk 4 or 5 feet in diameter, which size it frequently attains within a hundred years.

The common elm appears to be one of the kinds mentioned by Pliny as known to the antient Greeks: he also notices four kinds as known to the Romans, but whether these were species or varieties cannot now be ascertained. The *U. campestris* is still common in Italy. On the Continent generally the elm does not appear to have been cultivated till recent times, although in England it has been so for time immemorial. It was first introduced into France for adorning public walks by Francis I., in 1540. The elm was sent from England to Spain during the reign of Mary, for the purpose of forming the avenues at Madrid, the Escurial, Aranjuez, &c.

In the planting and cultivation of the common elm, two objects are held in view, ornament and use. Speaking of it as an ornamental tree, Gilpin says, in his 'Forest Scenery,' it 'has not so distinct a character as either the oak or the ash. It partakes so much of the oak, that when it is rough and old, it may easily at a little distance be mistaken for one, though the oak (I mean such an oak as is strongly marked with its peculiar character) can never be mistaken for the elm. This is certainly a defect in the elm, for strong characters are a great source of picturesque beauty. This defect however appears chiefly in the skeleton of the elm: in full foliage its character is more marked. No tree is better adapted to receive grand masses of light. In this respect it is superior to the oak and ash; nor is its foliage, shadowing as it is, of the heavy kind. Its leaves are small, and this gives it a natural lightness: it commonly hangs loosely, and is in general very picturesque. The elm naturally grows upright, and, when it meets with a soil it loves, rises higher than the generality of trees; and after it has assumed the dignity and hoary roughness of age, few of its forest brethren (though, properly speaking, it is not a forester) excel it in grandeur and beauty. The elm is the first tree that salutes the early spring with its light and cheerful green, a tint which contrasts agreeably with the oak, whose early leaf has generally more of the olive cast. We see them sometimes in fine harmony together, about the end of April and the beginning of May. We often also see the elm planted with the Scotch pine. In the spring its light green is very discordant with the gloomy hue of its companion; but as the year advances, the elm tree takes a darker tint, and unites in harmony with the pine. In autumn also the yellow leaf of the elm mixes as kindly with the orange of the beech, the ochre of the oak, and many of the other fading hues of the wood.' A great recommendation of the elm is its endurance of a smoky atmosphere, and it will thrive in the vicinity of large towns. The noble elms of the parks of London are a living testimony of its value in this respect. Many of the public avenues in France, Holland, and Great Britain are composed entirely of this tree; and its growing in almost every variety of soil, and requiring but little pruning, are, in addition to its ornamental qualities, strong recommendations.

As a timber-tree the uses of the elm are very considerable. The wood loses a great deal by drying; a cubic foot weighing 70 lbs., is, according to Selby, only 28 lbs. when dry, but according to Loudon 48½lbs. The wood is of a brownish colour, and is hard and fine-grained. It is used extensively for various kinds of work in ship-building. It is sometimes coloured, and made to look like mahogany, when used by cabinet-makers. It withstands well the action of water, and on this account it is used for making pumps, water-pipes, &c. It is also used for making the keels of ships. In districts where there are salt-springs this wood is used as a trough to convey it; and as these springs were called wyches, the name wych-elm, which is now given to one species, the *U. montana*, was applied to all elms. In some places the leaves and young shoots are used as fodder for cattle. In Russia the leaves are employed as a substitute for tea. They formed also a large proportion of the article called 'herb-tea,' the sale of which was prevented by the Excise. The inner bark of the elm is very tough, and may be used for making mats and ropes, in the same manner as the lime. Amongst the Romans the elm was employed for training the vine. Thus Virgil reproaches Corydon for the condition of his vines and elms, the one being half pruned, and the other too leafy:—

> 'Semiputata tibi frondosa vitis in ulmo est.'—*Eclog.* ii.

It also appears to have been the tree selected by the Romans for making their *bures*, or plough-handles:—

> 'Continuo in sylvis magni vi flexa domatur
> In burim, et curvi formam accipit ulmus aratri.'
> *Georg.*, i., 168-9.

The English elm frequently attains a great age. Some trees that were planted in the Luxembourg at Paris during the reign of Henri Quatre were standing till the first French revolution. A tree was cut down by Sir Hans Sloane, at Chelsea, that was said to have been planted by queen Elizabeth; it measured 13 feet in circumference, and at one time was 110 feet in height. Some elms in the neighbourhood of London have attained a height of 120 feet. The Crawley Elm is 61 feet in circumference at the base of the trunk, and is hollow inside to the very top of the trunk, which is about 70 feet high. There is a door into the hollow, the key of which is kept by the lord of the manor. It is occasionally opened for the purpose of holding a convivial party, it being capable of containing upwards of a dozen people seated. 'The Hollow Tree of Hampstead,' which used to be visited as a curiosity, was an elm. It was engraved by Hollar in 1653, and the following description was given of the tree:—'1. The bottom above ground in compass is 28 foote. 2. The breadth of the door is 2 foote. 3. The compass of the turret on the top is 34 foote. 4. The doore in height to goe in is 6 foote 2 inches. 5. The height of the turret is 33 foote. 6. The lights into the tree is 16. 7. The steppes to goe up is 42. 8. The seat above the steps six may sit on, and rounde about roome for fourteene more. All the way you goe up in the hollow tree.' Several other elms of great age and size have been recorded by writers on arboriculture. (Loudon, *Arb. et Frut. Brit.*, p. 139.)

The recorded varieties of *Ulmus campestris* are very numerous, and Loudon enumerates eighteen. Some of these have been constituted species by various botanists. The following are the most important:—

U. c. vulgaris. This variety is very twiggy, has pale smooth bark, and is irregular in its growth, and its branches are almost horizontal. The wood is of inferior quality, and care should be taken to exclude it where timber is the object of growth. Selby says, it has unfortunately been substituted for the species in many parts of the north of England.

U. c. alba is an upright tree; the old bark cracks very much, and becomes pale with age; the leaves are shining, and doubly serrated; the bark of the young shoots is tinged with red. The timber of this variety is good. The variety called *U. c. acutifolia*, with tapering leaves and pendulous branches, also affords good timber, and is common in the counties of Norfolk and Suffolk.

U. c. virens, is a variety that is almost evergreen, and is commonly called the Kidbrook Elm: it is a delicate tree, and often becomes injured by the frost.

U. c. cornubiensis, the *U. stricta* of Lindley, the Cornish elm, is a lofty tree, with small, strongly varied, conaceous leaves; the branches bright brown, smooth, rigid, erect, and very compact. This tree is a fortnight later than the common elm in producing its leaves. Some of these trees have attained a great size: there is one in Bagshot Park 70 years old, and 90 feet in height.

There are several varieties of the *U. campestris*, which are planted as ornamental or curious trees. Amongst those deserving of notice are the *U. c. viminalis*, *U. c. betulæfolia*, *U. c. parvifolia*, and *U. c. chinensis*.

Ulmus suberosa, the Corked-bark Elm. This species, which derives its name from the corky nature of its bark, is supposed by Selby and others to be only a variety of *U. campestris*. It has pointed, rough, doubly and sharply serrated leaves, with stalked flowers 4- or 5-cleft; the samara almost orbicular, deeply cloven, glabrous; the branches spreading. This tree has a hardier constitution than the foregoing species, and consequently is much more generally distributed. It is found in Great Britain wherever *U. campestris* grows, and in many districts it is abundant, as in Scotland, where that tree is very seldom seen. It is now becoming quite naturalized in Ireland, and is frequently met with on the continent of Europe. In regard to form, beauty, and picturesque effect, this tree is decidedly inferior to the last, and its timber is very much less valuable, but still it deserves attention on account of its hardy constitution, and its power of adapting itself to very inferior soils. It forms also a good stock on which to engraft the English elm, and Mr. Selby recommends it to be planted as a nurse for other trees in cold and exposed tracts where the soil is indifferent, and also as a fence around plantations of young Scotch firs. Several varieties of this tree are known to arboriculturists, varying in their habit, size, form, and colour of their leaves, &c.

Ulmus major, the Greater or Dutch Cork-barked Elm, is considered a species by Smith, and recognised by Lindley and Hooker. It has rough ovato-acuminate leaves, very oblique at the base, sharply and doubly serrated, pubescent below, with dense tufts of white hairs in the axils; branches spreading, bright brown, winged with corky excrescences, when young nearly smooth; fruit obovate, slightly cloven, naked. This is a finer and more graceful-looking tree than the last. It has larger leaves, and the bark is even more corky. It is not an uncommon tree in Holland, and the elms upon the Boom-Key of Rotterdam belong to this species. It was brought to Great Britain by William III., and the elms in the old part of Kensington Gardens are of this species; but it produces timber of an inferior quality, and is now seldom planted.

Ulmus effusa, the Spreading Elm. This is not a British species. It has doubly-serrated leaves, unequal at the base; pedunculated, pendulous flowers, with the margin of the fruit (samara) ciliated. This tree is a native of Russia, where it attains a great size. The wood is hard and durable, and is used where it grows for all the purposes of the common elm. It is said that the leaves come out three weeks or a month sooner than those of other species and varieties. There is little doubt but this is a distinct species: the disposition of its branches gives it a very distinct character, even when it is destitute of leaves, and its long pedunculated flowers and hairy fruit are very obvious differences between it and the foregoing species.

Ulmus montana, the Mountain, Scotch, or Wych Elm. It has obovate, cuspidate, doubly and coarsely serrated leaves, nearly equal at the base, exceedingly scabrous above and downy beneath, bark smooth; fruit scarcely cloven, naked. Whatever may be the doubts as to the introduction of the *U. campestris* into Britain, there are none with regard to this species, which is always allowed to be British. It is more abundant in the northern than the southern parts of England, and it becomes more abundant as it approaches Scotland; and in that country this tree forms the most prominent object in its picturesque wooded scenery. It is also a native of Ireland, but on the Continent it appears to give way to the *U. campestris*. This is a handsomer tree than the English elm. Sir Thomas Dick Lauder, in his edition of Gilpin's 'Forest Scenery,' says of it: 'For our part we consider the Wych or Scottish Elm as one of the most beautiful trees in our British Sylva. The trunk is so bold and picturesque in form, covered as it frequently is with huge excrescences; the limbs and branches also are so free and graceful in their growth, and the foliage is so rich, without being heavy or clumpy as a whole, and the head is generally so finely massed, and yet so well broken, as to render it one of the noblest of park trees; and when it grows wildly amid the rocky scenery of its native Scotland, there is no tree which assumes so great or so pleasing a variety of character.'

The leaves of the Wych-Elm are larger than those of the English Elm. It produces an abundance of seed, in which also it differs from *U. campestris*, but it does not throw up suckers as that tree does. The timber of this tree is not considered by Selby so valuable as that of the English Elm, but it has been applied generally to the same purposes, and there are many writers who give it the preference for carpentry and ship-work. Selby says it neither possesses so much heart-wood, nor is the lateral adhesion so great as that of the English Elm. In some parts of the country the Wych-elm is called *witch*-elm, and is supposed to possess a charm over evil spirits. To this belief may be referred the practice of putting a small portion of witch-hazel into the churn, in order that the butter may come without any demoniacal molestation. The wych-elm often attains a great size: mention is made by Cook of one whose height was 120 feet, the diameter of the trunk 17 feet, and when felled it was computed to weigh 97 tons. The Tutbury Elm belongs to this species, and is supposed by Strutt to contain 689 cubic feet of timber.

The varieties of Wych-Elm are not quite so numerous as those of the English Elm. Loudon enumerates ten, and to these many more might be added. The Cevennes Elm (*U. m. cebennensis*), the black Irish Elm (*U. m. nigra*), the Weeping Elm ((*U. m. pendula*), and the Exeter Elm (*U. m. fastigiata*) are those most deserving of notice, the two last as ornamental varieties.

Ulmus glabra, the Smooth-leaved Elm, is sometimes considered a variety of the last species. The leaves are ovato-lanceolate, acuminate, doubly and evenly crenato-serrate, cuneate and oblique at the base, quite smooth above, smooth or glandular beneath, with a few hairs in the axils; branches bright brown, smooth, wiry, weeping; fruit obovate, naked, deeply cloven. This tree is a native of Britain, occurring in the greatest abundance in the county of Essex. It ripens its seeds as *U. montana*, but does not throw up suckers as *U. campestris*. Some very fine varieties of the elm have been raised from this species. That known as the Huntingdon or Chichester Elm (*U. g. vegeta*) is one of the finest. It is one of the most rapid-growing trees of the genus, and its timber is said to be excellent. It is a more upright tree than the *U. montana*. The Scampston Elm is also another variety, which is common in some parts of Yorkshire and Nottinghamshire. It is a tree of very rapid growth, but the trunk becomes rotten at the heart sooner than most of the varieties of elm. The Downton Elm, a weeping variety, also belongs to this species. Loudon enumerates seven other varieties known in nurseries.

Ulmus Americana, the American Elm. The petiole of the leaf is 1-1½ inch in length, covered with short hairs; the disk unequal at the base, four or five inches long, serrated, and mostly doubly so; axils of the veins joined by a membrane; the flowers are seated on peduncles, the peduncles short, glabrous; the stamens five to eight; the fruit ovate, acute, ciliated. Its flowers resemble those of *U. effusa*. This tree is found in North America, growing in low woods from New England to the Carolinas, where it attains a height of from 80 to 100 feet. It was introduced into Europe as early as 1752, but neither as an ornamental nor useful tree has it been found to be superior to the European species, so that very few specimens are now to be seen in this country. There are some small trees of this species in the London Horticultural Society's garden, and some very fine ones in the garden at Trianon in France. The wood of this tree is used for the same purposes in the United States as the English elm in Europe.

Ulmus fulva, the Slippery Elm, has rough whitish branches; ovate-oblong acuminate leaves, nearly equal at the base, serrate with unequal teeth, very rough and hairy on both surfaces; the leaf-buds tomentose, scales of flower-buds downy; fruit not ciliated. This tree is also a native of North America. It is less abundant than the last species, but Michaux states that, 'except the maritime districts of the Carolinas and Georgia, this species of Elm is found in all parts of the United States and Canada.' The wood is of a darker colour than the last species: hence in America they are known as the white and red elm. The wood is not so good as that of *U. Americana*, but it is used for a variety of useful purposes. The name Slippery Elm has been given to this species on account of its leaves, bark, and branches, when macerated in water, yielding a thick and abundant mucilage. It is often thus used as a demulcent drink in catarrh, and otherwise as a substitute for the marsh-mallow.

Ulmus alata, the Wahoo, or Cork-winged Elm, is another American species. It is a small tree, seldom exceeding thirty feet in height, and is characterized by the bark dilating on each side of the branches between the leaves, and giving them a winged appearance. This plant was introduced into this country in 1820, and is cultivated on account of its singular branches, and not for the value of its timber, which is inferior.

Cultivation of the Elm.—The English Elm (*U. campestris*) does not perfect its seeds in this country, so that it cannot be propagated by seed. In the South of England the usual way of propagating the elm is by layers, or suckers, which are thrown out in great numbers by the superficial roots. Layers are said to produce finer trees than suckers. It has been a common practice to propagate the English elm by grafting it upon a stock of the Wych-elm; but Selby condemns the practice, and thinks it has led to the stunted growth of the English elm, as the *U. montana* always requires a better soil than the *U. campestris*. The English elm grows and thrives on soils of a very inferior description, both of a light and heavy kind. After it has attained a considerable size, there is no tree that bears removal so well as the English elm. When once planted, it seldom requires the pruning-knife, although none will bear lopping better. This fact is made painfully apparent by the hideous figures that a majority of the elm-trees around London are called upon annually to make, from the practice of lopping off all their side branches. This practice is pursued for the purpose of making the timber straight, but it cannot be too generally known that it effects no such object, materially diminishes the growth of the tree, and disfigures the country into the bargain. When planted in masses, the young trees ought to be kept wide apart, as they require both space and air to attain all the vigour of which they are susceptible. In the cultivation of the Wych-elm more care is necessary: if planted on an inferior soil, it will not flourish, and this will account for the disappointment of many who have planted this tree on inferior soils. It grows well at first, even on a poor soil, but it will never attain any perfection as a timber-tree. As a general rule this tree does not grow well or profitably in masses; but by the banks of rivers, and in steep declivities which cannot otherwise be cultivated, where there is a rich soil, it may be advantageously planted. As an ornamental and hedgerow tree it may be introduced in all districts with a rich soil. The Wych-elm may be propagated by seeds. These ripen about the middle of June, and should be gathered from the tree. If sown directly they frequently vegetate the same season, and may be run into nursery-rows, the following spring, and may be again transplanted when they are a year old. The Wych-elm does not send up suckers, but its layers strike very readily, and it may be thus conveniently propagated.

Diseases and Insects of the Elm.—The Elms are all very subject to a disease called ulceration. It appears on the body of the tree, at a height generally of three or four feet from the ground. The bark commences decaying, and the disease extends gradually to the interior of the tree. The spot discharges a great quantity of sap. The process which goes on appears to be a combination of the elements of the wood with the oxygen of the atmosphere, but no plan has yet been pursued that will arrest the progress of decay. Another disease to which the elm is liable is the deposit of cambium between the wood and the bark, without the formation of additional tissue: the consequence is, that the cambium becomes putrid, and oozes out of a cavity in the bark.

The insects that feed and live upon the elm are very numerous, but none of its assailants produce any serious injury to its growth, with the exception of the *Scolytus destructor*, a little beetle belonging to the family *Bostricidæ* of Leach. It was at one time supposed that wherever elm-trees were found decayed, with the larvæ and ova of the *Scolytus* in the wood, this insect had produced the decay; but it was proved by experiment that the Scolyti did not produce the decay, but that they had recourse to decayed or diseased trees for the purpose of depositing their ova. M. Audouin however states that the perfect insect of the Scolytus feeds upon the wood of the elm, and that it will attack young elm-trees, and induce in them that state of decay which the female selects as the appropriate place for the deposit of her eggs. A knowledge of this fact is of great importance, as sometimes thousands of trees may be attacked by these insects, and instances are on record of whole forests being thus destroyed. The remedy proposed by M. Audouin is the examination of the trees, for the purpose of ascertaining whether the Scolytus has attacked them. Where there are no holes and no furrows, such as the larvæ of these insects make, the trees are secure; but where the presence of larvæ is detected by the holes or furrows, the tree must be cut down, and entirely destroyed by fire. Where there are only holes made by the insect for the purpose of eating the wood, the tree should be painted over with gas-tar, which will prevent any further attack of the insect. These are only recent suggestions (1836) of Mr. Audouin, and there has not yet been time to prove their efficacy.

For further information on the elm, consult Loudon's *Arboretum et Fruticetum Britannicum; Selby's British Forest-trees;* Lindley, *Synopsis of the British Flora;* Gilpin, *Forest Scenery; The Cyclopædia of Plants.*

ULMUS CAMPESTRIS, *Medical Properties of.* The bark of this species is officinal: it should be collected in spring from branches not too old: the outer bark is removed, and the interior, or *liber*, retained for use. When recent it is of a whiteish-yellow colour, but when dried it is externally of a cinnamon hue, and curled up; the inner surface smooth; it is from a quarter to half a line in thickness, tough, fibrous, not easily powdered, devoid of smell, with a mucilaginous, bitterish, astringent taste.

The cold watery infusion becomes green on the addition of a solution of sesquichloride of iron, and a precipitate is thrown down by a solution of gelatin. Rinck's analysis gives in the 100 parts—resin, 0·63; gum and mucus, 20·3; impure gallic acid (tannin), 6·5; oxalate of lime, 6·3 (?); chloride of sodium (?), 4·6: what the remaining constituents were is not stated. Sir H. Davy (*Phil. Trans.*, 1803, p. 233) obtained from one ounce of elm bark thirteen grains of tannin. From the sap collected in May, Vauquelin obtained acetate of potash, acetate of lime, vegetable matter, carbonate of lime, and talc, carbonic acid, a trace of sugar, sulphate and chlorate of potash. It possesses demulcent, tonic, and astringent properties; and taken in full doses it accelerates the pulse, acting ultimately as a diaphoretic and diuretic. Though known from an early period as an astringent, it is little used at the present day, notwithstanding the testimony of Lettsom and others in favour of its utility in cutaneous diseases of a scaly kind. To do good it must be persevered in for many months, and the greater its action on the kidneys the greater the probability of ultimate benefit. Its agreeable taste reconciles many to the prolonged use of it, who would reject less pleasant medicines. It is commonly administered in the form of decoction, but as the bark contains much starch, this is objectionable. An infusion made with cold water is far preferable. A pint or more of this is to be taken daily.

The Ulmus fulva, tawny-budded or slippery elm bark of America, is a very valuable demulcent, tonic, and astringent, and of great utility in the diarrhœas and dysenteries of the southern parts of the United States. It is there thought a good substitute for sarsaparilla. As an emollient this bark is of great service as an external application to wounds, bruises, chilblains, and cutaneous eruptions; for these it is generally made into a poultice. The bark of this tree is probably that which is termed *cortex unguentarius*, which is in high repute with the aborigines for the cure of wounds. The slippery elm bark, from the quantity of mucilage and starch it contains, is very nutritious, and can alone sustain life for many days. The large proportion of mucilage in other elm-barks causes them to be used in the West Indies to clarify sugar.

U'LPHILAS. [GOTHIC LANGUAGE.]

ULPIA TRAJA'NA. [TRANSYLVANIA.]

ULPIA'NUS, DOMI'TIUS, a distinguished Roman jurist, was either a native of Tyre in Phœnicia, or his ancestors were of that place. The year of his birth is not known. Tyre was made a Roman colony by Septimius Severus, as appears from that emperor's medals (Rasche, *Lexic. Rei Numariæ*, 'Tyrus'); but if that was the first Roman settlement at Tyre, Ulpian could owe nothing of his Roman education to that city, even if it was his native place; and his own words only prove that he or his ancestors were from that place. In the reign of Septimius Severus and of his son Antoninus Caracalla (A.D. 198-211), he was a writer on law, but more particularly under the sole reign of Caracalla, as appears from various passages in his writings where he speaks of Severus as 'divus,' a term which implies that Severus was then dead, and of Caracalla as 'imperator noster,' or the reigning prince. Ulpian was banished by Elagabalus, but the elevation of Alexander Severus to the imperial power (A.D. 222) opened to him the road to new honours. He became scriniorum magister and præfectus annonæ, and was a particular favourite of the emperor. He also held the office of præfectus prætorio under Alexander Severus; Lampridius doubts whether he received this appointment under Elagabalus or Alexander Severus, though it is stated that he certainly held it under Alexander. If he held this office under Elagabalus, we must assume that he was deprived of it on his banishment. Ulpian was a confidential adviser of Alexander, and exercised great influence over him. Xiphilinus, the epitomator of Dion, fixes on Ulpian the imputation of clearing the way for his promotion to the dignity of prætorius præfecto by causing the execution of his predecessors. This fact is not mentioned by any other antient authority, and it is inconsistent with the character which Lampridius gives Ulpian, whom he calls a good man. Ulpian was murdered shortly after (A.D. 228), in the night-time, by the prætorian soldiers, in the palace of Alexander, and in the presence of the emperor and the emperor's mother. (Dion, lib. 80.)

Ulpian was one of the most fertile of the Roman writers on law. His chief works, as they are known to us from the 'Florentine Index' and the excerpts in the 'Digest,'

llowing:—The great work 'Ad Edictum,' in
books at least, was probably founded on the
of Julian, and itself was almost the basis of Jus-
Digest.' This work, with the fifty-one 'Libri ad
the twenty books 'Ad Leges Juliam et Papiam
,' the three books 'De Officio Consulis,' ten
De Officio Proconsulis,' the six books on 'Fidei
,' two books of 'Institutiones,' and others, was
in the reign of Caracalla. The work of which a
is still extant, entitled 'Domitii Ulpiani Frag-
was written either in the reign of Caracalla
ex constitutione Imperatoris Antonini,' Tit.
or after Caracalla's reign. This, which is gene-
nsidered to be a fragment of his 'Liber Singu-
gularum,' consists of twenty-nine titles, and is a
source for our knowledge of the Roman law.
ment, together with the 'Institutiones' of Gaius
has enabled us to attain to more correct views on
torical development and the connection of the
parts of the Roman law. Though it had long been
o jurists, it is only within the present century that
been used with that critical discrimination which
ly of Roman jurisprudence most especially requires;
this we are mainly indebted to the labours of
and Savigny. These fragments treat chiefly of the
ating to persons and marriage, and on testaments,
and fidei-commissa. Among Ulpian's other works
bably one 'De Interdictis,' in four books at least,
ainly a work 'De Officio Prætoris Tutelaris,' both
are mentioned in the 'Vaticana Fragmenta.'

le of Ulpian is clear, but more diffuse than that
ant contemporary Paulus. He was a man of
l an accomplished jurist. Ulpian and Paulus,
dius Scævola, are called by Modestinus (Dig.
13), who was Ulpian's pupil, the chief of juris-
φαῖοι τῶν νομικῶν); and his superior merit was
ledged in the time of Justinian, whose great
from the writings of the Roman jurists, the
ains extracts from twenty-three of Ulpian's
oportion of the extracts from Ulpian is about
whole compilation.

been brought both against Paulus and Ul-
ostile to Christianity. But the passage in
Instit., v. 11) which is cited in confirma-
may not apply to this Ulpian; and if it
is not decisive.

an, as he is called in the Greek argu-
Athenæus, is one of the speakers in
s,' and he is mentioned (p. 686, ed.
died happily, 'without having given
nity to disease,' which seems a sin-
to his death, if the circumstances
ated. But it is not certain that this

Jurisconsultorum, and Zimmern,
rivatrechts, where the authorities
dius, *Elagabalus* and *Alexander*
Fragmenta quibus in Cod. Vat.
Corpore Ulpiani, *accedunt Frag-*
utionibus, *&c.*, *iterum edidit*,

Three persons of this name are

ophist, and the author of va-
an 'Art of Rhetoric.'

other of Isidore the philo-
putation for mathematical
ay be concluded that he
s a contemporary of Sy-
lived in the fifth century,
of his are mentioned by

ian, the contemporary
puted author of Pro-
τις) on the Olynthiac
Demosthenes. There
ries on the Orations
Symbuleutici,' and on
on against Leptines,'
printed in Dobson's
in other editions.
Venice, 1503, with
Οὐλπιανου ῥήτορος προλεγόμενα εἰς τοὺς Ὀλυνθιακοὺς καὶ Φιλιππικοὺς Δημοσθένους λόγους. Ἐξήγησις ἀναγκαιοτάτη εἰς δέκα τρεῖς τοῦ Δημοσθένους λόγους.

It is not certain that Ulpian of Antioch was the author of the Commentaries on Demosthenes. Suidas attributes to him various works, but does not mention the Commentaries.

ULSTER, the northernmost of the four provinces into which Ireland is divided. It is bounded on the north and west by the Atlantic Ocean, on the east by the Irish Sea, on the south-east by the province of Leinster, and on the south-west by that of Connaught. It is comprehended between 53° 45′ and 55° 25′ N. lat., and between 5° 25′ and 8° 50′ W. long.

It comprehends the following nine counties. We give the area from the Ordnance Survey:—

	Area in Eng. Acres, from the Ordnance Survey.
Three northern counties, including the county of the town of Carrickfergus:—	
Antrim (including Carrickfergus)	761,882
Londonderry (formerly Coleraine)	518,401
Donegal	1,193,443
One central county:—	
Tyrone	806,296
Five southern counties:—	
Fermanagh	456,531
Cavan	477,360
Monaghan	319,849
Armagh	328,076
Down	611,918
	5,473,756 acres,
	or 8553 sq. miles.

Ulster is mountainous. Two mountain groups cross the province from east to west. The northernmost, which passes through the counties of Antrim, Londonderry, and Donegal, is divided into three parts by the valleys or depressions through which the Bann and the Foyle reach the sea. The mountains of Donegal are the loftiest: several of the peaks rise to the height of more than 2000 feet; and one (Erigal) is 2460 feet above the level of the sea. The coast of Donegal is very rugged, marked by deep inlets, as Lough Swilly and Lough Foyle (between Donegal and Londonderry), stupendous cliffs, bluff headlands, and numerous islands. The southern mountains commence on the east coast, in the county of Down, where Slievh Donard, one of the Mourne Mountains, rises to the height of 2796 feet above the level of the sea. The other mountains in the southern part of the province are lower, and extend through the counties of Monaghan, Cavan, and Fermanagh. A lower and comparatively level district intervenes between the northern and southern mountains, and occupies a considerable part of the counties of Down, Armagh, and Tyrone, extending from Lough Belfast and Lough Strangford on the east, to Lough Erne and Lough Derg on the west. Lough Neagh is in this central low country: it is less than 50 feet above the level of the sea, and has low shores. [NEAGH, LOUGH.]

The mountains of Donegal and Londonderry are chiefly of mica-slate, except in the north-west of Donegal, where they consist of granite and quartz rock. The mountains of Antrim are of tabular trap. The basaltic rocks known as the Giant's Causeway are on the north coast of Antrim.

The Mourne Mountains are granitic: the other southern mountains consist of grauwacke, grauwacke-slate, clay-slate, old red-sandstone, yellow conglomerate (the lowest member of the carboniferous limestone series), or millstone-grit.

The principal rivers flow from south to north, rising in the southern mountains, crossing the intermediate low country, and passing through openings in the northern mountains into the Atlantic. Several flow in different directions into Lough Neagh, of which the Bann is the outlet. Others unite in the Foyle. The principal lakes are Lough Neagh, in the centre of the province; and Loughs Erne (upper and lower), Derg, Macnean, and Nilly, in the south-west. Belfast Lough, and Loughs Strangford, Larne, Foyle, and Swilly, are land-locked inlets of the sea.

The population of the province at different epochs was as follows:—

Date.	How ascertained.	Inhabited Houses.	Families.	Families chiefly employed in Agriculture.	Families chiefly employed in Trade, Manufactures, Handicraft.	Families not included in the preceding classes.	Males	Females.	Total.
1792	Estimated by Dr. Beaufort .	214,800	..	..	..	..	..	..	..
1821	Under Act 55 Geo. III., c. 120 .	359,801	390,709	..	..	..	968,061	1,030,433	1,998,494
1831	Under Act 1 Wm. IV., c. 19 .	402,005	425,314	268,864	88,421	68,029	1,113,094	1,173,528	2,286,622

Ulster was one of the five provinces into which, at an early period, Ireland was divided. In this province the northern Hy Nialls, or O'Neills, had their seat. In the Anglo-Norman invasion, the earliest attack upon Ulster was made (A.D. 1177) by John de Courcy, who conquered part or the whole of Ulidia (now the county of Down and part of Antrim), and extended his incursions with various success into other parts of the province. He assumed or received the title of earl of Ulster; but on his decease his lands and title were transferred to Hugh de Lacy, and the title was inherited by the De Burgh and Mortimer family, from the last of whom it came to the dukes of York, and with them to the crown of England. The greater part of the province remained however in the hands of the native chieftains until a comparatively late period: the counties of Down and Newtown, under one sheriff, were formed at an unknown period, probably at the time of De Courcy's invasion: they are recognised as having existed 'in times past' in a patent roll of 20 Edward II. (A.D. 1335): a sheriff of the counties of Antrim and Carrickfergus, and a sheriff of the county of Coulrath or Colerain, were appointed A.D. 1335; but whether for the first time does not appear. There were at the same time sheriffs of the counties of Ardes and Lecale, which are now only baronies in the county of Down. There were some parts of Ulster under the jurisdiction of the sheriff of the county of Dublin about the close of the thirteenth century; and about A.D. 1347 there was a district called the Cross of Ulster, Crocea Ultoniae, in which there were sheriffs or other officers distinct from the sheriffs of the counties. The other counties now existing were formed by Sir John Perrot, A.D. 1584; but in two of them (Tyrone and Tyr-Connell, or Donegal) no sheriffs were appointed until A.D. 1603, probably through the great insurrection of the natives under Hugh O'Neill, earl of Tyrone. Subsequent insurrections having led to extensive forfeitures in the six counties of Donegal, Tyrone, Coleraine (now Londonderry), Fermanagh, Cavan, and Armagh (comprehending the greater part of the soil), it was determined to bestow them on Englishmen or Scotchmen, or 'Servitors in Ireland,' or on natives of Ireland, who were to be made freeholders, all termed 'undertakers,' to whom were severally assigned lots of 1000, 1500, and 2000 English acres, upon different tenures, on condition that they should build on each of the largest (or 2000 acre) grants a castle, and on each of the other grants a brick or stone house, each castle or house surrounded by a strong court-yard or 'bawn;' and should settle or 'plant' a certain number of tenants, who were to be Scotch or English, except on the lands of the 'Irish servitors,' who might take English or Irish tenants at their choice. Large grants were assigned to the corporation and some of the trading companies of the city of London, from which the town and the county of Derry received the distinctive prefix of their name, London-derry. Conformity in religion to the laws of the realm was required from the undertakers, except perhaps from the Irish, who were to be admitted as freeholders. There were to be 'a convenient number of parishes and parish churches in each county, towns were to be incorporated and markets established, and free-schools to be instituted for the education of youth. Though the plan was but imperfectly fulfilled, and though in the dreadful insurrection of 1641 the settlers suffered dreadfully, yet so many English and Scotch settlers were permanently established as have stamped a peculiar character on the population of Ulster, which is at present the great seat of manufacture in Ireland, and the part in which the Protestant religion (Episcopal and Presbyterian) is most prevalent.

(*Ordnance Survey*; *Parliamentary Papers*; Ware's *History and Antiquities of Ireland*, by Harris; and Moore's and Leland's *Histories of Ireland*.)

U'LTIMUS, De Montfort's name for a genus of shells, type *Ovulum gibbosum*, *Bulla gibbosa*, Linn. [CYPRÆIDÆ, vol. viii., p. 258.] The only reason for this designation that we can perceive is, that this genus is the last in the *Conchyliologie Systématique*.

ULTRAMARINE, a well-known blue pigment of extraordinary beauty and great permanence. It was originally, and indeed until within a few years, entirely prepared from the lapis lazuli, or lazulite. [LAZULITE.]

This colour is now prepared in France at a very moderate price, and equal in beauty to that obtained from the lazulite. M. Gmelin of Tübingen considers that sulphuret of sodium is the colouring-principle both of the natural mineral and the artificial products. The artificial ultramarine is stated to be prepared by adding freshly precipitated silica and alumina, mixed with sulphur, to a solution of caustic soda, and the mixture is to be evaporated to dryness: the residue is put into a covered crucible and exposed to a white heat, by which, when the air has partial access to it, a dark pure blue mass is obtained. The product is then reduced to impalpable powder. The proportions of materials to be used are, about 36 silica, 36 alumina, 24 soda, and 3 sulphur.

ULUG BEG. The real name of this prince was Mirza Mohammed Targai,[*] but he is better known by the sirname of Ulug (or Ulugh) Beg. He was the grandson of Timur, being the son of Shah Rokh, the son of Timur, and was born A.H. 796 (A.D. 1394). He governed his father's territories as regent, his capital being Samarcand, from an early age until A.H. 851 (A.D. 1447), when he succeeded to the throne by his father's death. His life was marked by the usual military successes, without which few Oriental princes of that time could keep their thrones; but as these are of little interest, and form none of his title to fame, we may omit the detail of them. He is said to have had the weakness to cast the horoscope of his eldest son Abdallatif, and, from some suspicions of his fidelity derived from the stars, to have preferred his younger brother. The consequence was that the elder son revolted, defeated and took his father, whom he caused to be put to death. Ulug Beg reigned in his own name only two years.

The astronomical labours of this prince have handed down his name. He was the founder of an observatory, and the patron of some of the best astronomical tables among those which preceded the invention of the telescope. It even appears that he was himself a diligent observer, and in some, perhaps a great degree, the author of the tables which bear his name. According to D'Herbelot, the tables were constructed, under his name and authority, first by his former instructor, Salaheddin Cadizadeh al Roumi, and, after the death of that astronomer, by Gaiatheddin Mohammed Giamschid al Couschgi. But the expressions quoted by Hyde, from the preface, are difficult to reconcile with any supposition except that of Ulug Beg being actually an observer.

The astronomical works of Ulug Beg were written in Arabic, but were afterwards translated into Persian, from which language the principal of them were translated into Latin by Greaves and Hyde. Greaves published first the chronological portion, under the title 'Epochæ celebriores Astronomicis, Chronologicis, Historicis, Chataiorum, Syro-Græcorum, Arabum, Persarum, Chorasmiorum, usitatæ, ex traditione Ulug Beigi,' London, 1650. He afterwards published the geographical part as an appendix to his 'Astronomica quædam ex traditione Shah Cholgii Persæ:' this appendix having the title 'Binæ Tabulæ Geographicæ, una' Nessir Eddini Persæ, altera Ulug Beigi Tartari,' London, 1652. Greaves is also said, by Hyde, to have published (but where we do not know) the places of 100 stars from Ulug Beg: and he had also prepared for the press the whole table of the places of stars, which he left in the hands of Archbishop Usher. Dr. Thomas Hyde, not knowing of what Greaves had done, published, in Latin and Persian, his 'Tabulæ Longitudinis ac Latitudinis Stellarum Fixarum, ex Observatione Ulugh Beighi,' Oxford, 1665, accompanied by a valuable series of notes, particularly on the Arabic names of the stars: the greater part of all this, if not the whole, was reprinted by Dr. G. Sharpe in 1767. A new edition of Ulug Beg's Catalogue, by Mr. Baily, will form part of the thirteenth volume of the 'Memoirs of the Royal Astronomical Society,' now (February, 1843) nearly ready for publication. The epoch of these tables is A.H. 841 (A.D. 1437), and the observations were made at Samarcand, long. 99° 16′, lat 39° 37′. Some description of the part which yet remains to be published has been given by Delambre, from a manuscript belonging to Lalande (*Astronomie du Moyen Age*, p. 208). The whole enjoys a high reputation for its times and the existing means of observing.

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[*] This, according to D'Herbelot, was the family of Timur's father.

U'LULA. [Strigidæ, vol. xxiii., p. 118.]

ULULI'NÆ. [Strigidæ, vol. xxiii., p. 118.]

ULVA'CEÆ, a tribe of Cryptogamic plants belonging to the natural order of Algæ, and to the inarticulate division of that order. Under the article Sea-weeds, the most important tribes of the division *Inarticulatæ* of the order *Algæ* were described, with the exception of *Ulvaceæ*, *Siphoneæ*, and *Lemanieæ*. We shall here confine ourselves to these tribes. Nearly all the forms of plants belonging to the order Algæ were in the time of Linnæus confounded under the names of *Fucus*, *Ulva*, and *Conferva*, but each of these genera has undergone extensive subdivision by late observers, and the order Algæ now contains nearly 200 genera and a vast number of species.

The *Ulvaceæ* include plants which are found in the sea, in fresh-water, or on the damp ground: they are generally of an herbaceous green or fine purple colour, and have a thin, tender, membranaceous, reticulated structure, rarely gelatinous; they are generally furnished with a very minute scutate root, which is either expanded or tubular and continuous; the reproductive organs consist of roundish, mostly quaternate granules, or minute opercular grains, which are imbedded in the delicate membrane of the plant. This tribe contains about ten genera, of which the five following are British: Porphyra, Ulva, Tetraspora, Enteromorpha, and Bangia.

Porphyra (from πορφύρεος), the Purple Laver, has a plain frond, exceedingly thin, and of a purple colour. The reproductive organs are of two kinds: 1, Roundish granules arranged in fours, and imbedded in the whole substance of the frond; 2, masses of smaller ovate granules, which are scattered without order, chiefly towards the margin of the frond. Four species of the Purple Laver are enumerated. The most common is the *Porphyra laciniata*, which has its fronds aggregated and deeply cleft, the segments dilated, and variously cut and waved. This plant is common in the sea from spring to autumn, and grows on rocks and stones, from whence it is often torn by the violence of the waves, and thrown on the shore. The frond of this plant abounds in a viscid gelatinous matter, which is very nutritious. On this account this plant, under the name of Laver, is much eaten in many places, especially the south of England. When collected, it is kept in jars with salt, and when brought to the table is served up with lemon-juice. Dr. Lightfoot states that in the Western Isles it is gathered in the month of March, and that when pounded and macerated with a little water, the inhabitants eat it with pepper, vinegar, and butter. It is sometimes stewed with leeks and onions. But although this plant is abundant enough, it is only very partially used as an article of diet.

Ulva (Green Laver) has a membranaceous frond of a green colour, with its reproductive granules arranged in fours. There are seven British species of Ulva: three growing in the sea, one in fresh-water, and three in damp places on the land.

U. latissima, the Broad Green Laver, has a plain widely oblong or roundish frond, waved, and of a green colour and tender substance. It is an abundant plant on the rocks and stones of the sea in summer and autumn. In common with *U. lactuca*, the Lettuce Green Laver, it is gathered and eaten in the same way as the purple laver. It is also known under the name of *Oyster Green*. This plant is popularly supposed to be good for scrofulous habits. It is sometimes applied to the forehead to relieve headache in fevers, and also to procure sleep. *U. bullosa*, the Blistered Green Laver, is the fresh-water species. It has an obovate, saccate frond, which is gelatinous, and at length becomes irregularly expanded, waved, and bullate. It is a very frequent plant in stagnant pools and ditches of fresh-water, often covering the whole surface of the water, and giving it the appearance of being in a state of fermentation. The terrestrial species of *Ulva* are found growing on walls, rocks, the roofs of thatched houses, and especially in places exposed to much moisture. *U. thermalis* grows in hot-springs at a temperature of 117° Fahrenheit.

The genus *Tetraspora*, named from the quaternary arrangement of its granules, inhabits fresh water, and includes two British species. The fronds are tubular or inflated, and gelatinous.

Enteromorpha, the Water-Gut, has a tubular, hollow, membranaceous frond, of a green colour and reticulated structure; the reproductive granules are arranged in threes or fours in the reticulations. Seven or eight species of this genus have been described as British. They are all inhabitants of the sea, or of pools and ditches of salt-water, with the exception of *E. intestinalis*, which is also found in fresh-water pools. All the species are long, varying from two or three inches to three feet in length, and when floating in the water very much resemble the intestines of an animal—hence their name.

Bangia was named after Hoffman Bang, a Danish naturalist, who wrote a work on the Confervæ. It has a flat, capillary, membranaceous frond, of a green, reddish, or purple colour. The situation of this genus is doubtful. Greville refers it to Ulvaceæ, but most botanists place it in or near Confervoideæ.

The tribe *Siphoneæ* consists of plants which are found in the sea, in fresh-water, or on damp ground, of an herbaceous green colour; the frond is either composed of membranaceous, filiform, continuous, simple, or branched tubes, or formed of a combination of similar tubes, forming a spongy or crustaceous, globular, cylindrical, or flat body; the reproductive organs are vesicles produced on the outer surface of the tubes, filled with a dark green granular mass. This tribe contains four genera: Codium, Bryopsis, Vaucheria, and Botrydium. The most interesting genus is Vaucheria, on account of the remarkable observations that have been made upon its reproductive granules by Unger and other botanists. [Vaucheria.]

Codium, the Sea-Purse, is a hollow, subglobose, dark green plant, composed of an interwoven mass of tubular continuous filaments, the reproductive vesicles being attached to the filaments near the surface of the frond. There are two British species found on submarine rocks. *Bryopsis* has two British species, which are also marine plants. The frond is membranaceous, filiform, tubular, cylindrical, glistening, branched; the branches are imbricated, or distichous and pinnated, and filled with a fluid containing minute granules. Their numerous branches give them the appearance of feathered mosses—hence their name. *Botrydium* (from Βοτρυς), the Grapelet, is nothing more than a spherical vesicular receptacle, filled with a watery fluid: it opens at the apex, and has, descending from the lower part, a bunch of radical fibres. In structure this plant resembles Codium, but it is much smaller, the receptacle not being bigger than a grain of mustard, and it grows upon the ground in moist shady situations. Granules are contained in the watery fluid within the plant, and, when the weather is dry, the upper part of the receptacle collapses, giving the plant a cup-shape.

The tribe *Lemanieæ* contains but one genus, *Lemania*. The species, of which there are two British, are aquatic plants, existing in fresh and always rapidly running waters. The fronds are slender, tuberose, formed of a tough cellular membrane, which is composed of regular cells, and interspersed with ducts; whorled with papillæ or moniliform. The surface of the frond, external and internal, is covered with minute simple or dichotomous, moniliform, articulated threads, which separate by age, and are the sporidia of the plant. The genus Lemania was named after a French botanist, M. Leman.

(Smith's *English Flora*, vol. v.; Burnett's *Outlines of Botany;* Vaucher, *Histoire des Conferves;* Lindley, *Natural System.*)

ULVERSTONE. [LANCASHIRE.]

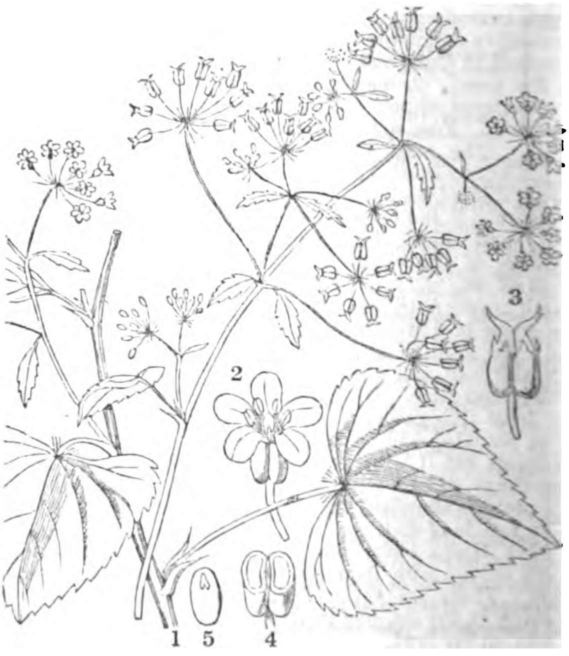
ULYSSES, ULYXES, or ULIXES, is the name under which the Greek hero Odysseus (Ὀδυσσεύς) was popularly known among the Romans. Ulysses, who is the hero of Homer's 'Odyssey,' was a son of Laertes and Anticleia, king of Ithaca, husband of Penelope, and father of Telemachus. The story about Ulysses, as related by Homer, has been much extended and modified by later poets and mythographers. In Homer he is represented as the model of a prudent warrior, as a man of great experience and cunning, always ready to devise means of avoiding or escaping from difficulties, as superior to all men in eloquence and intelligence, in wisdom equal to the gods themselves, and in adversity courageous and undaunted. Later poets, on the other hand, describe him as a cowardly, false, and intriguing person. When the Greek chiefs had resolved upon their expedition against Troy, Agamemnon went to Ithaca to invite Ulysses to join them, but it was not without difficulty that he was induced to assist in the enterprise. He joined the other Greek chiefs in the port of Aulis, with twelve ships. During the war against Troy he acted a very prominent part, sometimes as a gallant warrior, and sometimes as a bold and cunning spy or emissary. At the taking of Troy he was one of the heroes concealed in the wooden horse. After the destruction of the city his sufferings began. He and his companions wandered about for ten years in the Mediterranean, endeavouring in vain to reach his native island, while his faithful wife Penelope was beset by numerous suitors, who consumed his property. The various calamities he had to encounter before he returned to Ithaca are immortalized in the 'Odyssey.' During the twenty years which he was absent from his home, he always enjoyed the especial protection of the goddess Athena (Minerva), and it was she who at last enabled him to reach Ithaca. His father Laertes was living in solitary retirement, and Ulysses, without being known, was hospitably received by Eumaeus, the swineherd. Telemachus, the son of Ulysses, who had in the meantime grown up to manhood, was absent: he had gone to Pylos and Sparta to obtain information concerning his father, but he returned while Ulysses was staying with Eumaeus. His father made himself known to him, and a plan was formed to get rid of the insolent suitors. Ulysses in the disguise of a beggar followed his son to the town, where he was insulted by the suitors and some of his own servants, but was welcomed by Penelope and recognised by his aged nurse Eurycleia. With the assistance of Athena, Ulysses, his son, and some of his faithful servants began a contest with the suitors, all of whom lost their lives. Hereupon Ulysses made himself known to Penelope, and went to his aged father Laertes. The news of the fall of the suitors excited their friends and relatives to take up arms against Ulysses, but Athena in the disguise of Mentor reconciled the people to their lawful king. Respecting his death the 'Odyssey' (xi. 119, &c.) only contains a mysterious prophecy of Tiresias, according to which he was to die a gentle death in his old age. According to later traditions Ulysses was killed by Telegonus, his own son by Circe, who had been sent out by his mother in search of his father, and was thrown by a storm on the coast of Ithaca, where he was attacked, while plundering the country, by Ulysses and Telemachus.

(Hyginus, *Fab.*, 127; Horat., *Carm.*, iii. 29, 8; Dictys Cretensis, vi. 15.)

UMBEL, in Botany, a form of inflorescence in which there are several flower-stalks all radiating from a common point, and having an equal length. When only a single flower is seated on each pedicel, the umbel is said to be *simple*, as in Eryngium, Butomus umbellatus, &c. If the primary pedicels have other smaller pedicels, which form of themselves a smaller umbel, which frequently happens, as in Heracleum, Fœniculum, Daucus, &c., the umbel is said to be *compound*, and the smaller umbels are called *umbellules.* The whole assemblage of the umbels is called the *universal umbel;* and the secondary umbels, or umbellules, are called *partial umbels.* The peduncles, which form the partial umbel, are called *radii.* The base of the pedicels of the simple umbel is often surrounded by bracts, which are then called an *involucre.* When they are present at the base of the primary pedicels of a compound umbel, they are called a *universal involúcre.* The peduncles of the umbellules are also often surrounded by bracts, which are called a *partial involucre*, or an *involucellum.* The possession of this form of inflorescence is the character of the large natural order Umbelliferæ, to which there are no exceptions. The characters which were afforded by the possession of the forms of the umbel, with the absence or presence of the involucra and involucella, formed at one time the principal means of subdividing that order. But at the present day the characters of the fruit and seed have quite superseded other modes of distinction. [UMBELLIFERÆ.]

UMBELLI'FERÆ, a natural order of plants. This is one of the best marked families of plants, so much so, that Jussieu says the whole order may be looked upon as a genus, and the various subdivisions and genera as arrangements of the species. All the species are well marked, and have good distinguishing characters, and their inflorescence is always that of the umbel. [UMBEL.] The possession of an umbel was early made the combining character of these plants by systematic botanists, and they were called Umbellatæ on this account. In addition to this distinguishing character, they have also others, as the possession of five stamens and two stigmas, by which they were all brought under the class Pentandria and order Digynia of Linnæus.

Most of the species are herbs, seldom shrubs, with fistular, furrowed stems. The leaves are, in most cases, divided; sometimes they are simple: they are alternate, and all of them embrace or clasp the stem by a sheathing petiole. The flowers are white, pink, yellow, or blue, and are seated on umbels, which are either simple or compound, and these are with or without bracts at their base, which are called involucre or involucellum, as they surround the umbels or umbellules. The calyx is superior, either entire or 5-toothed. The petals are five, and are inserted on the outside of a fleshy disk, which is placed on the top of the ovarium: they are usually inflexed at the point, and have an imbricate, rarely valvate æstivation. The stamens are 5, and are seated alternately with the petals, and are incurved during æstivation. The ovary is inferior, 2-celled, having solitary pendulous ovules, and is crowned by the disk, on which the petals are seated; the styles are 2, distinct, with simple stigmas. The fruit, which is ordinarily called the seed, consists of 2 carpels, which are united by a common axis, the part by which they unite being called the commissure; the external part of each carpel is traversed by elevated ridges, which are divided into primary and secondary: there are five of the latter, and four, between them, of the former; the



[Hydrocotyle Spananthe.]

1, cutting showing umbels with flowers and fruit: 2, flower enlarged; 3, fruit; 4, transverse section of fruit; 5, seed removed from pericarp, with small embryo and large albumen.

ridges are separated by channels, below which are often placed, in the covering of the fruit, little receptacles of coloured oily matter, which are called vittæ. The seed, which is pendulous, usually adheres to the sides of the cell of the fruit, and this has led to the confounding the seed and fruit together. The embryo is minute, and is seated in the midst of a horny albumen, with the radicle pointing to the hilum.

Lindley places this order in his albuminous group of orders, on account of the large quantity of albumen in proportion to the size of the embryo contained in the seed. In this manner it is brought into close connexion with Ranunculaceæ and other orders, from which it is mostly separate in other systems. The order agrees with Ranunculaceæ in its sheathing leaves, as well as its large albumen and its acrid properties. Other relations have been pointed out, as with Saxifragaceæ, Geraniaceæ, also with Araliaceæ, from which it differs little, except in the number of the parts of the flower.

The arrangement of this order has always been a matter of difficulty, arising from the circumstance of the whole family being connected together by so many peculiar characters. The same difficulty arises in the subdivision of other orders, in which the primary characters are well marked, as Compositæ and Gramineæ. Many early attempts were made to constitute the genera of this order from the general characters of the plant, and it is not till lately that the fruit had been studied with sufficient attention to afford much assistance. Morison, Tournefort, Linnæus, and Adanson founded the genera upon various distinctions of structure in the entire plant. Cusson first pointed out the value of the structure of the fruit in the making the genera, and his suggestions were adopted by Jussieu, in his 'Genera Plantarum.' Sprengel and Hoffman have given arrangements of this order; the former founded his genera entirely on the fruit, whilst the latter employed both the fruit and petals. Of the genera thus formed, Sprengel describes 63; Don, in 'Miller's Dictionary,' gives 171; and Lindley, in his 'Natural System,' 189. The following conspectus will show the suborders and tribes into which these genera have been distributed by De Candolle:

Umbelliferæ	SUBORDER I.—ORTHOSPERMEÆ. Albumen of seed flat on inner surface, neither involute nor convolute.	Hydrocotyleæ. Mulineæ. Saniculeæ. Ammineæ. Seselineæ. Angeliceæ. Peucedaneæ. Tordylineæ. Silerineæ. Cumineæ. Thapsieæ. Daucineæ.
	SUBORDER II.—CAMPYLOSPERMEÆ. Albumen rolled inwards at the edges.	Elæoselineæ. Caucalineæ. Scandicineæ. Smyrneæ.
	SUBORDER III.—CŒLOSPERMEÆ. Albumen curved inwards from base to apex.	Coriandreæ.

Tausch has more recently proposed another arrangement, and objected to the albumen being made the basis of the primary divisions of the order.

The genera include above 1000 species. These are principally inhabitants of the northern temperate zone, and the greater number of them are found in the old world. The proportion of species in the southern half of the world, compared with the northern, is as 1 to 4; that of the new to the old world, as 1 to 3. Very few of the species are found in the tropics, and about 50 are enumerated as inhabitants of Australia.

The properties of this order are variable, and very important. One of the distinguishing characters of the order is the possession of an acrid principle which finds its full development in such plants as the Hemlock (*Conium*), the Cow-bane (*Cicuta*), Œnanthe, Helosciadium, Æthusa, &c. This renders the whole order suspicious, more especially the vegetation, in which the poisonous principle is most developed. The acrid properties of these plants seem to depend upon the possession of a peculiar principle, which in as far as it has been examined in some of the species possesses alkaline properties. This is the case with Conia, a principle obtained from the Hemlock [CONIUM], which has been examined with the most care, although other plants of the order have been found to yield similar principles, but not possessing so much activity. Conia is remarkable amongst the vegetable alkaloids, for being fluid, volatile, and easily decomposed; and it is probable that most plants whose poisonous properties are dissipated by heat possess a principle of a similar nature. In this respect there is also another analogy between the Umbelliferæ and Ranunculaceæ, the poisonous qualities of the species of the last order being in a great measure annihilated by heat. It is not improbable that all the Umbelliferæ may possess a principle similar in nature, though not in intensity, to the Conia, and that it may contribute in some measure to render such plants as the parsley, samphire, and celery desirable as articles of diet.

Another important secretion of the Umbelliferæ is a volatile oil. This secretion is found in all the species, with the exception of Conium, deposited in the canals of the pericarp, which are called vittæ. In some of the species it is more abundant than in others; and on this account the fruit, which is commonly called the seeds, is used frequently in diet as a condiment, and in medicine as an aromatic and carminative. Of these the carraway, the anise, the dill, the cumin, and coriander are best known. The secretion of oil however does not appear to be confined to the vittæ of the fruit, as many of the species have an aromatic odour, which is exhaled from their leaves and stems. It has been asserted by Lindley, Don, and other writers on Umbelliferæ, that the fruit 'is in no case dangerous;' but this is an error, as the fruit of the Hemlock contains more of the active poisonous principle than any other part of the plant, and has on this account been introduced as a distinct article of Materia Medica in the New London Pharmacopœia, and a case of poisoning recently occurred in France, from the fruit of hemlock being served by mistake in a druggist's shop for the anise, which it closely resembles. An account of this case, with the mode of distinguishing between the fruit of the hemlock and other Umbelliferæ, by Dr. Pereira, is given in the 'Pharmaceutical Journal' for 1842.

A third secretion of these plants is a gum-resin. This probably, like the two last secretions, is common to the whole order, but is fully developed in only a few species. The gum-resins produced by this order have had a great reputation in medicine, and many of them are still looked on as valuable remedies. The Laser, or Silphion of the antients, is secreted by plants belonging to this order, and assafœtida, galbanum, gum-ammoniacum, opoponax, and sagapenum are much used as stimulant medicines in nervous diseases at the present day. Many of the species when wounded exude in small quantities a gum-resinous matter.

A fourth secretion, which also on account of its occasional excess renders this order important to man, is starch. This secretion, which forms so large a portion of the food of animals, is deposited in largest quanties in the roots of the carrot, the parsnep, the skirret, and the aracacha of the South Americans, and on this account these plants are extensively cultivated. Most of the roots however contain this principle, and might be used as articles of diet, but that they also contain the poisonous principle of which we have before spoken. Heat will dissipate this, and some of the roots which are deadly poisonous when raw, it is said may be eaten with impunity when cooked. The roots of some of these plants resemble that of the horseradish, and in winter, when the leaves are gone, may be dug up in gardens in mistake for it. Fatal consequences have in some cases ensued from such a mistake. Many of the Umbelliferæ are much affected in their secretions by climate and cultivation. Thus the deadly hemlock in Russia is an inert and eatable plant, whilst the celery of our gardens, if cast on the roadside, becomes an active poison. The properties of all plants are more or less affected by climate and cultivation, but it is much more obvious where poisonous secretions are increased or diminished, as in the hemlock, or changed, as in the case of the celery.

(Jussieu, *Dict. des Sciences Naturelles;* Lindley, *Natural System:* Don, Miller's *Dictionary;* Burnett's *Outlines;* Christison's *Dispensatory;* Bischoff, *Lehrbuch der Botanik.*)

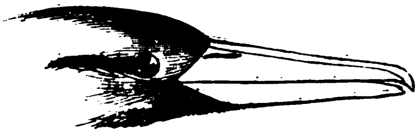
UMBER (Ornithology), a name of the *Scopus umbretta*, *Ombrette* of the French.

The genus *Scopus*, Brisson (*Cepphus* of Wagler) is generally placed among the HERONS [vol. xii., pp. 165, 166].

The *Ardeinæ* (Herons) of Mr. G. R. Gray form the third subfamily of his *Ardeidæ*, and are arranged by him between the *Gruinæ* (Cranes) and the *Ciconinæ* (Storks).

The *Ardeinæ* comprise the genera *Eurypyga*, *Ardea*, *Herodias*, *Ardeola*, *Botaurus*, ——? (*Ardeola*, Briss. ——? *minuta*), *Tigrisoma*, *Nycticorax*, *Scopus*, *Cancroma*, and *Platalea*.

Scopus is distinguished from the Storks by its compressed bill, whose trenchant culmen is expanded towards the base: the nostrils are prolonged into a furrow which runs parallel to the culmen to the end, which is slightly hooked.



Bill of Scopus.

Generic Character.—Bill straight, broad, much compressed: the tip of the upper mandible abruptly hooked, and of the lower truncated. Culmen and gonys carinated. Nostrils linear, closed, wings long. Tail short. Legs moderate. All the toes united by a membrane. The inner shortest. (Sw.)

Example, *Scopus umbretta*.

Description.—Size that of a crow, colour that of umber: the male with an occipital crest.

Locality.—Africa, generally.

Scopus umbretta.

UMBER, an ore of iron and manganese, employed as a brown pigment. Occurs massive, amorphous. Structure earthy. Fracture conchoidal. Soft. Opaque. Dull. Meagre to the touch; adheres strongly to the tongue, and falls to pieces in water. Colour blackish, reddish, or yellowish brown. Specific gravity 2·206.

It occurs in beds with brown jasper in the Isle of Cyprus.

It is stated to consist of—

Oxide of iron	48
Oxide of manganese	20
Silica	13
Alumina	5
Water	14
	100

UMBILI'CUS (Conchology). When the inner sides of the whorls or volutions of a spiral shell do not touch each other, so that its axis is hollow, that hollow is termed the *umbilicus*. [TROCHIDÆ; TURBINIDÆ.]

UMBILI'CUS. This word has sometimes been applied to the focus of an ellipse; but, in modern works, it stands for a point of a surface through which all its lines of curvature pass. At such a point the two principal curvatures are equal. (*Differential Calculus*, *L. U. K.*, p. 440.)

UMBO (Conchology). The name for that point in a conchifer or bivalve shell which constitutes the nucleus or apex of each valve, and which is generally situated above the hinge, and always near it. [CONCHIFERA, vol. vii., p. 433.] From this nucleus or umbo the longitudinal rays of the shell diverge, and the lines of growth, commencing immediately around the nucleus or umbo, increase in gradually enlarging concentric layers to the outer margin of the valve. In the freshwater bivalves the *umbones* are generally eroded. [NAIADES.]

UMBRA. The Latin word has been used to signify the shadow of the earth or moon in an eclipse: the word *penumbra* is still retained [ECLIPSE] to signify that portion of the heavens which is partially shaded.

UMBRELLA (Italian, *Ombrella*, *Ombrello*), from the Latin *Umbra* (Italian, *Ombra*; French, *Ombre*), a shade, a portable dome-like canopy, carried over the head as a shelter from the rays of the sun, or from rain and snow. Although the name is applicable in either case, and perhaps most strictly in the former, the term *umbrella* is usually applied in this country only to such as are used as a protection against rain, while the name *parasol* (Italian *parasole*, from *parare*, to parry or ward off, and *sole*, the sun) is given to the light kind of umbrella carried by ladies as a defence from the heat of the sun. The French have a better distinction between the two kinds of umbrella; using the name *parasol* for those used to ward off the rays of the sun, and *parapluie* (from *pluie*, rain) for those used as a defence against inclement weather. Umbrellas were introduced into Europe, in comparatively recent times, from the East, where they have been used for shelter against the sun from time immemorial. They are alluded to in the plays of Ben Jonson, and of Beaumont and Fletcher; and in Gay's 'Trivia' is the following notice of their adaptation to English use:—

> 'Let Persian dames the umbrella's ribs display
> To guard their beauties from the sunny ray,
> Or sweating slaves support the shady load
> When Eastern monarchs show their state abroad.
> Britain in winter only knows its aid
> To guard from chilly showers the walking maid.'

While, as implied by the above lines, umbrellas were pretty well known in London more than a century since, they did not come into general use for many years later. Jonas Hanway is said to have been one of the first men who commonly used an umbrella in England. At first they were kept in the halls of genteel houses, for holding over persons as they stepped to their carriages; and even long after they began to be used by pedestrians, they were considered signs of effeminacy if carried by males. Increased attention to comfort, and the reduced price of umbrellas, owing to competition and improvement in their manufacture, have now rendered them almost as essential as articles of dress, even to the humblest classes.

The construction of common umbrellas, and the contrivances by which they are made to expand or collapse at pleasure, are too familiarly known to need description; and it is unnecessary to do more than mention some of the ingenious improvements which have been devised, of which several are described in Hebert's 'Engineer's and Mechanic's Encyclopædia,' vol. ii., pp. 829-831. In umbrellas of the ordinary construction the ends of the ribs are connected with the fixed ring upon the end of the stick, and the ends of the metallic rods called stretchers are attached to the sliding-tube, by rings of wire; so that the axes upon which they turn when the umbrella is opened and closed form arcs of a circle, instead of straight lines, by which excessive friction and destructive wear are occasioned. The outer ends of the stretchers, also, are connected with the ribs by means of axes or pins passed through the latter, by which they are so weakened that they frequently break. These defects are remedied in the improved umbrellas above referred to, by the adoption of ingenious though simple joints. Another joint for connecting the stretchers with the ribs, allowing the framework to collapse into less space than usual, and preventing the fretting or wear of the cover at the ends of the stretchers, is described in the 'Transactions' of the Society of Arts, vol. xxxviii., pp. 72, 73. Very light and compact umbrellas are made with ribs of steel instead of whalebone or cane, which latter material, stained to resemble whalebone, is used in those of the commoner sort; and some of the best umbrellas and parasols are made with hollow or tubular metallic sticks, which combine lightness with strength.

UMBRELLA. [Semiphyllidians, vol. xxi., p. 217.]

UMBRI, OMBRI, or O'MBRICI, are mentioned by Dionysius, Pliny, Florus, and other historians, as one of the oldest people of Italy. They appear to have been living, at a very remote period, near the Sabini, in the highlands of the central Apennines, whence they descended into the valleys of the Tiber and the Nar, where they built the towns of Ameria, Tutere or Tuder, Ikuviu or Iguvium, Mevania, Nuceria, Nequinum, and others. The Umbri spread also beyond the Apennines, towards the coast of the Adriatic. Sarsina, on the river Sapis, and Sentinum, were towns of the Umbri, north of the Apennines. The Umbri came into collision with the Etruscans, who defeated them, and took many towns from them. (Pliny, iii. 19.) The epoch of this event is not authenticated, but it must have occurred previous to the fall of the kingly government at Rome, at which period the power of the Etruscans was at its greatest height, and their territory extended from sea to sea, including part of the country of the Umbri. The Umbri, like the other antient nations of Italy, formed a number of distinct communities or tribes, of which Pliny gives a long enumeration in the passage above quoted. Some of these became incorporated with the Etruscans, whilst others, particularly those who lived between the Tiber and the Nar, retained a separate existence, and the name of Umbri. When the decisive struggle between the Etruscans and the Romans took place, about 308 B.C., we find that the Camertes Umbri, a tribe on the borders of Etruria, offered to assist the Romans in their attack upon their Etruscan neighbours. (Livy, ix. 36.) It is worthy of remark that the emissary sent by the Romans, and who was acquainted with the Etruscan language, was enabled thereby to converse with the Camertes Umbri, and enter into negotiations with them. That the language and customs of the Umbri resembled those of the Etruscans is presumed also from the bronze tablets, called the Eugubian tables, which are partly written in the Etruscan and partly in the Latin characters, and which, according to Lanzi, relate to the religious rites of the Umbri, in which the 'Tarsinate Turscum,' an Etruscan tribe, is mentioned as having participated. (Micali, *Storia degli Antichi Popoli Italiani*, vol. i., ch. 5.) The charge of sensuality brought against the Etruscans has also been applied to the Umbri: 'Aut porcus Umber, aut obesus Etruscus' (Catullus, 40, 21).

After the defeat of the Etruscans, the Umbri made, too late, an effort to check the advance of the conquering Romans. The consul Decius, who had advanced into Etruria, retraced his steps to oppose the new enemy, and the other consul, Fabius, who was fighting against the Samnites, was ordered by the senate to march round against the Umbri, who had assembled at Mevania. This joint movement damped the spirits of the Umbri, and their army dispersed to their several strongholds. Only one tribe, called Materina, kept the field, and attacked the camp of Fabius, but was defeated, B.C. 307. In a short time most of the communities of Umbria submitted to Rome without much resistance. Sarsina, however, was one of the last to submit.

Umbria, under the Roman republic, was one of the divisions of Italy proper, extending from Ocriculum on the south to Ariminum and Pisaurum on the Adriatic coast. On the east the river Æsis separated Umbria from the Picenum, and the Nar from the Sabinum. On the south, Umbria bordered upon Latium, and on the west upon Etruria. The Rubicon formed its boundary towards Cisalpine Gaul.

After the fall of the Western empire, the name of Umbria was restricted to the country between the Tiber, the Nar, and the Apennines, and constituted the best part of the duchy of Spoleto. Since the annexation of that duchy to the Papal state, the name has continued to be applied commonly to the same region, which now forms the administrative province of Spoleto proper, as distinct from Rieti, which is considered as part of the Sabinum. [Spoleto e Rieti; Delegazione di.]

U'MBRIA. [Umbri.]

UMBRIAN SCHOOL OF PAINTING. [Roman School of Painting.]

UMEA-ELF. [Bothnia.]

UMERAPOORA. [Amarapura, i., 413.]

UMPIRE. AWARD. The word umpire is sometimes used to denote the person who in the first instance decides a controversy; but in its legal sense it means a person named in the Submission, or under its authority, by the arbitrators [Arbitration] to decide the matters referred, which the arbitrators either cannot or will not decide.

The rules which govern an arbitrator regulate the conduct of the umpire also. Two questions however often arise out of his proceedings. The act 3 & 4 Will. IV., c. 42, § 39, which gives leave to a judge of the court named in the submission to enlarge the time for making the award, has practically disposed of one of these questions, viz. whether, the time for making an award being limited by the submission, an umpire could, to the exclusion of the arbitrators, make his award before the time had expired within which these, although they had expressed their intention not to proceed in the reference, were nevertheless competent to make their award. The second question, and one of far greater practical importance, is, whether an umpire may take up the evidence where it has been left by the arbitrators, or must hear the whole matter anew. The rule may be thus stated: If arbitrators agree upon certain matters referred to them, but are unable to agree upon others, the umpire may adopt and incorporate in his umpirage the former, and may himself decide upon the latter. Again: If arbitrators are unable to decide upon matters concerning which they have heard the evidence, they may report that evidence to the umpire, and his award thereon will be good, provided that before it was delivered neither party required of him to hear the evidence afresh.

In former days courts of law interpreted awards most strictly, setting them aside if they were deficient in any of the conditions essential to their validity. Of late years however it has been the policy of the superior courts to support awards to the utmost. Thus, although a certain stamp (1*l.* 15*s.*) is required on an award, yet the absence of it may be amended by the payment of the penalty. So, again, an award ought not to direct things to be done which are impossible, or illegal, or affecting persons who are not parties to the submission, or things not submitted for the decision of the arbitrators; yet if these faults in the award are not essential to the maintenance of the whole, if (in other words) the performance of the legitimate part of the award does not depend upon compliance with that which is beyond the jurisdiction of the arbitrators, the court will maintain the award so far as it is good, rejecting only the remainder.

The main quality required in an award is, that it shall finally dispose of the matters referred. For this purpose it must be certain: for instance, it must not order that the one party shall pay to the other such a sum as certain goods are worth; or that he shall deliver up to the other 'several books' without naming them or otherwise specifying them: but it may be in the alternative, as that A shall vacate a house on a certain day, or pay 100*l.* The award must dispose of all the matters referred. It must not leave anything to be done in these matters by a party foreign to the submission, unless for some merely ministerial purpose: thus an award would be bad which gave to A the moiety of a certain field in issue, and in the possession of B (these being the litigants), provided that C found A's title to the moiety to be good: but the award would stand if it gave the moiety to be measured by C. An award must not reserve power to the arbitrators: for instance, that if A shall not pay a sum on a future day, then that the parties shall come before the arbitrators for their further award. For the mode of enforcing an award, see Arbitration, vol. ii., p. 252. (Kyd, *On Awards*.)

UNAU. The intimate connection of the Sloths with the Megatherioids, admitted by some zoologists, but strongly denied by others, is in our opinion set at rest by Professor Owen's 'Description of the Skeleton of an extinct Gigantic Sloth, *Mylodon robustus*, Owen, with Observations on the Osteology, Natural Affinities, and probable Habits of the Megatherioid Quadrupeds in general,' published by direction of the council of the Royal College of Surgeons in London,* and forming the second of a series which we hope to see from the same quarter.

Our limits will not permit us to follow the Professor through the minute, necessary, and satisfactory detail of the comparative anatomy of this gigantic extinct South American animal, which has been followed out with patient care by him till the remains form a complete skeleton, one of the principal ornaments of the noble museum in which it is preserved, a monument of the liberality of the council of the College, and of the talent of the distinguished physiologist, who built it up bone by bone, described it, and directed the admirable lithographic plates which illustrate the description.

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* 4to. John Van Voorst.

In the article *Megatheriidæ* will be found all that was known of the genus *Mylodon* when that article was written; in Professor Owen's book, just published, and above alluded to, the history of all the known Megatherioids is completed. And although we cannot, for the reason above assigned, follow the Professor step by step in his investigation, we shall endeavour to lay before our readers the substance of his physiological and zoological summaries, and attempt to give them some idea of his well-digested 'Conspectus' in an English dress. With regard to the Summaries, we regret that our limits compel us to abridge that which is already so closely condensed by the author.

Physiological Summary.

Professor Owen, after stating that it has been his aim, in the work above referred to, to place the new facts yielded by the study of the skeleton of the *Mylodon* in a clear and intelligible light, and in their true relations to those before acquired from the osteology of existing and extinct Edentate animals, proceeds to deduce the consequences which flow from them.

The Sloths are characterised by a dentition still more peculiar and extreme in its modification than that of the Ruminants, and this character appears in the form, number, general composition, intimate structure, and mode of growth of their teeth, which are especially adapted for acting on buds and leaves. The dental characters of the Sloths co-exist in the extinct Megatherioids with the bradypodal modifications of the jaws and cheek-bones, implying the same development and disposition of the masticatory muscles.

The extinct large Phyllophagans have peculiar modifications of structure to enable them to obtain leaves. Thus the whole frame, and particularly the long neck of the **Giraffe**, enable it to browse on branches far beyond the reach of its congeners the *Deer*, and its muscular extensile lips, and long, flexible, prehensile tongue, admirably co-operate with the skeleton in the act of acquiring its leafy provender.

The strongly-contrasted short thick neck of the **Elephant**, with its massive proportions, is aided by the wonderful prehensile proboscis; and the animal, so differently organized, is thus enabled to obtain a similar food.

The skeletons of the *Megatherium* and *Mylodon* also manifest remarkable peculiarities, and the signification of these is first inquired into.

In the Megatherioids, quadrupeds of approximate bulk to the Elephant and Giraffe, but neither normally proboscidian nor of towering height, a modification of bodily frame was required which might endow them with ability to browse on leaves or twigs. Their nearest living congeners, the light and diminutive sloths, climb for their sustenance. Prehensile as well as locomotive powers were gained by the modifications of the osseous frame-work of the *Mylodon*, as is most strikingly manifested in the claviculate and unguiculate fore-limbs with their freely rotatory fore-arm, the slightly inverted hind-foot, and the great and curved claws. A comparison of the fore-limbs of *Mylodon* with those of other beasts proves that this Megatherioid had its anterior extremities formed not exclusively for grubbing up or digging away soil, nor for climbing, nor for seizing, but for all these actions. This their true use is to be made out by the rest of the skeleton. But before we refer to that, it is necessary to consider the construction of one of the principal instruments, the fore-foot. 'In the habitual burrowers, whose feet are best organized for displacing the dense earth, as the Mole, the Mole-rat, the Condylure, and Echidna, the claws are long and broad, of nearly equal size on each digit, and can be extended in the same plane as the hand, which is of considerable breadth. In those Armadillos which are most remarkable for their rapid perforation of the soil, as the *Dasypi gigas* and *uni-cinctus*, the three outer claws, which are principally developed for that office, are scarcely less remarkable for their great breadth than for their length, but they are of unequal size. The breadth of the long fossorial claws of the Orycterope also surpasses their depth. In the Sloths, on the contrary, the depth or vertical diameter of the claws, which are unusually long, much exceeds their transverse diameter or breadth; they are also more curved than in the burrowers, and are much restricted in their movements, especially in that of extension. The fore-foot of the Sloths is likewise long and narrow, and only three fingers in one species and only two in another species are furnished with claws, which are nearly of equal length. The climbing Ant-eater (*Myrmecophaga didactyla*), which destroys the tree-termite, has its two toes shaped nearly as in the Sloths. The Great Ant-eater, which breaches the strong fortresses of the terrestrial termites, has its long fore-claws of nearly equal breadth and depth, and the chief power of the fossorial extremity is concentrated on one digit, which is much superior in size to the rest. In the work to which this modified digging instrument is put, the soil has not to be displaced in great quantities, as in the excavation of a hiding-place or burrow, but it needs only to be partially disturbed in order that something which is hidden may be exposed.

'The Megatherioid quadrupeds are not characterized by the true fossorial hand, in which all the five digits are provided with sub-equal, long, and broad claws; but at most only two or three of the digits were provided with claws. The depth of these claws exceeded their breadth in the Megatherium, especially in the longest and largest claw: the more curved and more compressed claws of the *Megalonyx Jeffersoni* very nearly resembled those of the Sloth. In the Mylodon, the claws, though equally remarkable for their length, and nearly as much curved as in the Megalonyx, were neither depressed as in the burrowers, nor compressed as in the climbers, but had their vertical and transverse dimensions equal. A portion of the hand, including the two outer digits, was modified after the ungulate type for the exclusive office of supporting the body in ordinary terrestrial progression.

'In the investigation of the nature of the collateral uses of the anterior extremity of the Megatherioids, to which uses all that is superadded to the ordinary structure of an ungulate limb relates, we must consider these superadditions independently, or exclusively of the parts which were merely concerned in progressive motion. The unguiculate portion of the fore-foot, thus viewed apart from the ungulate portion, agrees with the scansorial type, being long and narrow, with long and curved claws, which appear to have been habitually in a state of flexion, and could hardly be extended in the same plane as the hand. These characters, though not manifested in so extreme a degree as in the Sloths, evidently indicate a fore-foot better fitted for grasping than for digging. Such a foot is not however an instrument unfitted for cleaving or displacing the earth: but rather, in so far as it differs from that of the Sloths, and is less fitted for climbing, it gains in fossorial power. It may be justly inferred from the diminished curvature and length, from the increased strength, and from the inequality of the claws, especially from the disproportionate size of that of the middle finger, that the hand of the Mylodon was occasionally applied by the short and strong fore-limb in the act of digging; but its close analogy with that of the Ant-eaters teaches that the fossorial actions were limited to the removal of the surface-soil in order to expose something there concealed, and not for the purpose of burrowing. Such an instrument would be equally effective in the disturbance of roots or ants; it is however better adapted for grasping than for delving. But to whatever task the unguiculate part of the hand of the Mylodon might have been applied, the bones of the wrist, of the fore-arm, of the arm and of the shoulder, alike attest the prodigious force which would be brought to bear upon its execution. The general organization of the anterior extremity of the Mylodon appears to be incompatible with the idea of its having been a strictly scansorial or burrowing animal, and at the same time both teeth and jaws decidedly negative the supposition that it was an eater of ants: for the two extremes in the length of the jaws are presented by the phyllophagous and myrmecophagous species of the Edentate order; and the anomalous brevity of the face, which characterises the leaf-eating Sloths, is repeated even to exaggeration in the Mylodon.'

Having thus received the answers, so to speak, given by the osteological characters of the fore-limb, we must proceed to interrogate the rest of these gigantic remains, and refer to the organization of the hind-limbs to ascertain whether they will afford any further light as to the functions of the fore-feet and the general habits of the Mylodon.

When, after a review of the pelvis and hind-limbs in existing scansorial, fossorial, or semi-fossorial quadrupeds, the same parts of the skeleton of the Mylodon or Megatherium are contemplated, the sudden and extraordinary increase of size and the massive proportions at once arrest and astonish the beholder, and imply powers and actions peculiar to the gigantic animals when living. We find in the enormous pelvis indications of unwonted muscular powers applied to the fore-limbs, and of the pelvis itself having been acted upon by forces as great from the hind-legs and tail. 'The enormous pelvis of *Mylodon*,' says Professor Owen, 'proclaims itself the centre whence muscular masses of unwonted force diverged to act upon the trunk, the tail, and the hind-legs.[*] Those muscles originating from the sacrum and the broad and extended lip of the ilium, as the sacro-lumbalis, the longissimus and latissimus dorsi, &c., and which pass forwards to extend the trunk and retract the anterior limbs, have left the most marked evidence of their size and energy of action in the long and strong spinal crest of the sacrum and in the broad, rugged, and anteriorly produced margin of the ilium. The fore-limbs being well adapted for grasping the trunk or larger branches of a tree, the forces concentrated upon them from the broad posterior basis of the body are manifestly adequate, and are precisely such as might be expected to have coöperated in the act of uprooting the tree or of wrenching off the branch so seized. But in order that the pelvis should possess stability and resistance equivalent to the due effect of the forces acting from it and so applied, it was necessary that it should be bound down as it were, and supported by members of corresponding strength.

'Accordingly, we find a thigh-bone, which, though surpassing the humerus in length, is yet not less than half as broad as it is long, and provided with trochanters and ridges, the fit attachments of the tendinous insertions of muscular masses which expanded upon the back-part and on the fore-part of the broad and capacious pelvis, and have there left, in strong and numerous inter-fascicular bony crests, unequivocal evidence of the power by which they resisted the efforts of the antagonizing muscles attached to the trunk and fore-limbs to draw forwards the pelvis and hind-legs. The preponderating weight of both these parts, and the extraordinary power of the muscles connecting them together, are quite inexplicable on the scansorial hypothesis of the Megatherioid animals; since, if they attained their food by climbing, the fore-legs would be the fixed point when the muscles attaching these to the pelvis were called into action, and the hind-extremities, needing only the requisite prehensile power, ought to have had their bulk reduced as far as was consistent with such power, in order to facilitate their being drawn upwards towards the fore-legs.

'A palæontologist, who has earned a just celebrity by his successful exertions in the discovery of the fossil Mammalia of Brazil, has pushed the hypothesis of the climbing habits of the Megatherioids so far as to hazard the conjecture that the Megalonyx, and in all probability the Megatherium, were furnished with a prehensile tail. Those arboreal quadrupeds, however, which have the advantage of this fifth hand, as it may be termed, such as the prehensile Porcupine, the didactyle Ant-eater, and the Spider-Monkeys, have a light body, a small pelvis, and slender hind extremities; and the colossal proportions of these parts in the Megatherioids would be still more enigmatical than they appear when applied to the ordinary scansorial hypothesis, if the tail had really been so important an instrument in the climbing actions as Dr. Lund conjectures. But it would seem from this able naturalist's allusion to the claws of his *Megalonyx Cuvieri*, viz. "that they are not compressed, as in the Sloth," such compressed claws being, in fact, one of the distinctive characters of Cuvier's genus *Megalonyx*, that the extinct Megatherioid which Dr. Lund had in view was a species of *Scelidotherium* or *Mylodon*. Now we know that the Mylodon had a strong and powerful tail, but too short for prehensile purposes, its proportions being exactly such as to enable it to complete, with the two hind-legs, a tripod strong enough to afford a firm foundation for the massive pelvis and adequate resistance to the forces acting upon and from that great osseous centre. The large and thick transverse and upper and lower spinous processes, and especially the prolonged and capacious spinal canal, indicate the bulk and strength of the muscular masses which surrounded the tail and connected it with the pelvis: the natural coädaptation of the articular surfaces shows that the ordinary inflection of the extremity of the tail was backwards, as in a 'cauda fulciens,' not forwards, as in a 'cauda prehensilis.' Viewing, then, the pelvis of the Mylodon as the fixed point towards which the fore-legs and anterior parts of the body were to be drawn in the gigantic leaf-eater's efforts to uprend the tree that bore its sustenance, the colossal proportions of the hind extremities and tail lose all their anomaly, and appear in just harmony with the robust claviculate and unguiculate fore-limbs, with which they combined their forces in the Herculean labour. The uncommon length of the sole of the foot, equalling in the Mylodon, perhaps surpassing in the Megatherium the length of the femur; the prolongation of the os calcis, which affords the strong posterior fulcrum, and the very powerful claw of the middle toe by which the opposite end of the foot would be kept fixed upon the ground,[*] become clearly intelligible, and their final purpose explicable on the above-developed idea of the exertions during which the well-based hind-limbs worked in steadying, and reacting upon, the trunk of the Megatherian wrestling with its passively but sturdily resisting source of subsistence. And thus the expanse of the pelvis, the superior bulk and strength of the hind-legs compared with the fore-legs, the peculiar length and organization of the hind-feet, the proportions and construction of the tail, all of which form a combination of characters common to the Megatherioids, and present in no other animals, yield the required explanation of the uses of the fore-extremities, which too nearly resemble those of other claviculate Edentata, to indicate, apart, their own proper functions in the Megatherioids.

'If the foregoing physiological interpretation of the osseous frame-work of the gigantic extinct Sloths be true, they may be supposed to have commenced the process of prostrating the chosen tree by scratching away the soil from the roots; for which office we find in the Mylodon the modern scansorial fore-foot of the Sloth modified after the type of that of the partially fossorial Ant-eater. The compressed or subcompressed form of the claws, which detracts from their power as burrowing instruments, adds to their fitness for penetrating the interspaces of roots, and for exposing and liberating them from the attached soil. This operation having been duly effected by the alternate action of the fore-feet aided probably by the unguiculate digits of the hind-feet, the long and curved fore-claws, which are habitually flexed and fettered in the movements of extension, would next be applied to the opposite sides of the loosened trunk of the tree; and now the Mylodon would derive the full advantage of those modifications of its fore-feet by which it resembles the Bradypus: the correspondence in the structure of the prehensile instruments of the existing and extinct Sloths extending as far as was compatible with the different degress of resistance to be overcome. In the small climbing Sloth the claws are long and slender, having only to bear the weight of the animal's light body, which is approximated by the action of the muscles towards the grasped branch, as to a fixed point. The stouter proportions of the prehensile hooks of the Mylodon accord with the harder task of overcoming the resistance of the part seized and bringing it down to the body. For the long and slender brachial and anti-brachial bones of the climbing Sloth we find substituted in its gigantic predecessor a humerus, radius, and ulna of more robust proportions,—of such proportions, indeed, in the *Mylodon robustus*, as are unequalled in any other known existing or extinct animal. The tree being thus partly undermined and firmly grappled with, the muscles of the trunk, the pelvis, and hind-limbs, animated by the nervous influence of the unusually large spinal cord, would combine their forces with those of the anterior members in the efforts at prostration. And now let us picture to ourselves the massive frame of the Megatherium, convulsed with the mighty wrestling, every vibrating fibre reacting upon its bony attachment with a force which the sharp and strong crests and apophyses loudly bespeak :—extraordinary must have been the strength and proportions of that tree which, rocked to and fro, to right and left, in such an embrace, could long withstand the efforts of its ponderous assailant.'

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[*] The muscles of the Megatherioid animals, besides their mass and the mechanical advantages afforded by the peculiar development of their bony attachments, were most probably characterized by the great energy of their vital contractility; since this quality of the muscles of the Sloth is so striking as to have forced itself upon the notice of the Marquis de Montmirail, who, in describing the habits of a living Unau in his menagerie, says, 'La force de ses muscles est incroyable.'—Buffon, *Hist. Naturelle*, 4to, t. xiii. p. 48.

[*] 'This use of the large hind-claw was first pointed out by Dr. Buckland (*Bridgewater Treatise*, i. p. 158); but the full value of the structure to the Megatherium could not be appreciated, when the hind-legs were supposed to merely aid in supporting the trunk, whilst one fore-leg was used to dig up roots.'

The tree being prostrate, we are next to look for indications of instruments fitted for stripping off the foliage. The Megatherium, whose teeth and jaws were adapted to the comminution of the coarser parts of tree-foliage, appears to have been endowed with a short proboscis, as an assistant to the tongue: and since, with lips and a nose modified to gain prehensile power, there would have been less need of an inordinate development of the tongue, the evidence of the proboscis of the Megatherium harmonises with the smaller size of its hypoglossal nerves, and with the diminution of the capacity of its mouth, occasioned by the narrowing of the palate and the mutual approximation of the lateral series of grinders. The elephant, hugest of existing phyllophagous quadrupeds, is characterised by a maximum of proboscis: the giraffe by a long and muscular tongue. Both a prehensile tongue and proboscis, but of moderate size, coexisted in the Megatherium. The Mylodon, which had no proboscis, was compensated for its absence by a more largely developed tongue, and is thus contrasted with the almost tongueless elephant.

It will at once occur to the reader that these Megatherian animals must from their habits of life have been unusually liable to blows from heavy falling bodies; and, to meet such danger, they were provided with a peculiar cranial organization. Extensive air-cells were introduced between the external and vitreous tables of the skull; and Professor Owen thus inquires into the probable cause of the fractures, from the immediately fatal effects of which the subject of his memoir appears to have been saved by virtue of that remarkable structure:—

'The Sloths, though specially and admirably organised for clinging to the boughs of trees, yet in the course of an existence exclusively spent therein are liable, through unforeseen contingencies of rotten branches or sound ones yielding to the force of winds, to be occasionally thrown to the ground; without attaching undeserved credit to the story of these excellent climbers choosing that abrupt and hazardous mode of descent by preference.* The coarse matted hair with which their light body is densely covered is well suited to break the force of such falls, whilst any injury to the brain seems to have been provided against by the strong double bony wall of the cranial cavity which results from the extension of the air-cells from the frontal along the upper part of the head to the occipital region. But the same structure exists to an equal or greater extent in the Mylodon, which, according to my interpretation of its organization, was not a climber, not subject therefore to a fall. Yet the liability of the Mylodon, in the habitual practice of uprending and prostrating large trees, to be struck by the trunk or some of the large branches, must have been greater than that of the Sloth to a fall from its tree; and therefore the advantage to the Mylodon of having a double brain-case would not be less.

'Certain it is that the habits of life, or the conditions under which the Mylodon existed, did render it obnoxious to violent blows on the head, and that it was owing to the extensive and deep cellular diploë of the skull that they were not, in the present instance, death-blows.

'It is at least not probable that any large mammiferous animal could have survived so extensive and complicated a fracture and depression of the vitreous table at the back part of the skull, as that which in the Mylodon is here confined to the outer table. Either of the blows, however, to the force of which that strong plate of bone has yielded, must have stunned and at least have temporarily disabled the animal; and, if inflicted by the paw of some sufficiently powerful carnivore, would have left the Mylodon its easy and unresisting prey. If the skull of an animal so destroyed had been preserved and afterwards discovered in a fossil state, the broken bones would not have presented any of those effects of the reparative processes which are so extensively manifested in the very remarkable specimen under consideration.

'It is not very probable that the Mylodon, if disabled and its skull fractured by a blow received in conflict with another of its kind, would have been suffered to escape: the victorious assailant would in all likelihood have followed up his advantage by a mortal wound, such as an irate Megatherium might easily have inflicted with its sharp and ponderous claw, if excited by combative or destructive instincts. Nothing, however, that has yet reached us of the habits of existing Edentata would lead to the supposition that the extinct ones were actuated by these instincts, or were characterised by less peaceful habits than those of the Sloths, the Ant-eaters, and Armadillos of the present day. Only in self-defence against the carnivorous Jaguar or Puma is the strong-clawed Ant-eater (*Myrmecophaga jubata*) reported to use successfully its powerful weapons, with the analogues of which a Mylodon or Megatherium might be conjectured to have produced the injuries in our present fossil, on the combative hypothesis of their origin. But in the conflict of the great Ant-eater with the Jaguar, the predatory assailant is overcome by the pertinacity of the grasp, not by the force of the blow. The only analogies, therefore, by which we can test the conjecture that the injuries in question were inflicted by another Megatherioid animal, diminish its probability.

'There is no certain or conclusive evidence that human beings coexisted with the Megatherian animals: but assuming a primæval race of Indians to have disputed the lordship of the American forests with the Edentate giants, and to have waged against them, as against all other inferior animals, a war of extermination, the same difficulty presents itself to the supposition of the recovery and escape of a stunned Mylodon from their deadly assaults with clubs and other weapons, as from the claws and teeth of the beasts of prey: for the flesh of the leaf-eating Megatherian would doubtless be as much prized for food by a human destroyer as that of the Sloth is by the Indians of the present day.

'With these difficulties, therefore, opposing themselves to the conjectures which naturally rise in the mind at the first view of the injuries on the skull of the extinct Mylodon, and which suggest the hostile attacks of some other animal as their cause, we are compelled to refer those injuries to the effects of some inanimate force, which, having felled the Mylodon and temporarily disabled it, was spent, and could not follow up the blow. To a huge denizen of the woods what accident more likely to produce such injuries than the fall of a tree? and what inhabitant of the forest more obnoxious to such an accident than one destined by its organization to be habitually engaged in uprooting, and therefore in danger from the fall of heavy trees? The form of the healed, as well as of the partly healed fracture, in both of which the fissures diverge from a longitudinal, instead of radiating from a central depression, accords better with a blow from a branch or trunk of a tree than with one inflicted by the point of a large claw. It must, therefore, be conceded that both the injuries, and the structure of the skull by which their immediate fatal effects have been obviated, accord with the habits assigned to the Megatherian animals in the present Memoir; while they can receive no elucidation from, nor appear in any way connected with, the acts of digging the earth for roots, or ants, or for concealment, which have been severally conjectured to be the habitual labour of the Megatherioids by Cuvier, D'Alton, and De Blainville.'

Zoological Summary.

The genera *Bradypus* and *Cholæpus* have been usually regarded as forming one of the most anomalous and isolated groups of mammiferous quadrupeds. Cuvier placed them in the lowest order of Unguiculata, and De Blainville has raised them to the highest or quadrumanous order, agreeably with an old opinion of Linnæus.

With the advantage of our present knowledge of the extinct Megatherioids, the tardigrade and scansorial Edentata, which appeared formerly to be a very restricted and aberrant group, are now recognizable as the small remnant of an extensive tribe of leaf-devouring and tree-destroying animals, the larger extinct species of which, with their gigantically developed but modified unguiculate structure, formed the lowest grade of mammals furnished with claws, and completed the transition to the Ungulata.

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* Buffon, 'Histoire Naturelle,' tom. xiii. p. 43.

Professor Owen observes that it would border upon the ridiculous to advocate the claims of the Mylodon to the quadrumanous order because its thorax was wide rather than deep, its muzzle broad and truncated, its pelvis expanded, the head of the radius round and apt for rotation, the inflection of the carpus and tarsus free, the long claws prehensile, and the diet exclusively vegetable. Yet the claims of the Megatherians to be associated with apes and lemurs are, he remarks, equal with those of the sloths.

The Megatherioids most probably, like the sloths, gave birth to a single and unusually large fœtus: in that particular they would coincide with the elephant and whale as much as with the ape. If their uterus was undivided, as in the sloths, they would agree with the Armadillos as well as the Quadrumanes. After other considerations of the probable condition of the brain, the dental system and structure, Professor Owen thus concludes his zoological summary:—

'The degradation of the armature of the jaws in this order produces, especially in the truly edentulous Ant-eaters, a resemblance to the class of birds in one of their best-marked characters; and amongst the implacental Edentata we find the jaws themselves assuming the form of a duck's bill in the Ornithorhynchus.

'It may be observed of the Sloths that they illustrate this affinity or tendency to the oviparous type by the supernumerary cervical vertebræ supporting false ribs, and by the convolution of the windpipe in the thorax, in the three-toed species; by the lacertine character of three and twenty pairs of ribs in the Unau; and by the single excrementory or cloacal outlet, by the low cerebral development, by the great tenacity of life and long-enduring irritability of the muscular fibre, in both species.[*] Most interesting, therefore, becomes the discovery that in one of the huge extinct Sloths another character, heretofore deemed peculiar to the class of birds, should have been repeated, viz. the bony confluence of the last dorsal and the lumbar vertebræ with the sacrum. All these indications of a transition to a lower class harmonise with the Cuvierian view of the zoological position of the Sloths, as members of one of the lowest and most aberrant orders of Mammalia; and all oppose themselves to the promotion of the Sloths to the Primates, and to their separation from the terrestrial Edentata, which afford in the Ant-eaters and Pangolins, the Echidna and Ornithorhynchus, so many additional retrograde steps towards the oviparous classes.

'It would be tedious to reiterate the special and gradational affinities of the Mylodon and its congeners to the different families of the Edentate order, since these have been so fully elucidated in the comparisons of the several parts of their skeletons. They establish the general conclusion that the existing arboreal and extinct terrestrial Sloths constitute a primary division or type of the order Bruta, or Edentata, equivalent to the tribe Loricata, or Armadillos, and to the true Edentata, or the Ant-eaters and Pangolins.

'The teeth and jaws give the essential character, and govern the aliment of the new primary group, of which the name *Phyllophaga*, here proposed, indicates the characteristic and peculiar diet.

'The characters of the tribe, of its families and genera, and of the extinct species especially noticed in the present Memoir, are given in the subjoined Synoptical Table.'

Conspectus

Of the families, genera, and species of the *Leaf-eating Bruta.*

Order Bruta, Linn., Fisch. (*Edentata*, Cuv.).

Teeth none; or wanting a neck and enamel.

Claws falculate, great, generally sheathed, bending downwards.

Tribe Phyllophaga (Leaf-eaters).

Teeth few, composed of vascular dentine, hard dentine, and cement; the vascular dentine forming the great axis of the teeth.

A descending apophysis in the jugal bone. The acromion concrete with the caracoid process.

Family I. *Tardigrada* (Syn. *Scansoria, Bradypodidæ*).

Feet long, slender, the anterior more or less longer than the posterior; fore-feet di- or tri-dactyle, hind-feet tridactyle; toes obvolute, falculate.

Zygomatic arch open. Tail very short.

Genus 1. *Bradypus*, Linn., Ill. (Syn. *Acheus*, F. Cuv.).

Genus 2. *Cholæpus*, Ill. (Syn. *Bradypus*, F. Cuv.).

Family II. *Gravigrada* (Syn. *Erudicatoria, Megatheriidæ*).

Feet short, very strong, equal or subequal, fore-feet penta- or tetra-dactyle; one or two of the external toes unarmed, fit for support and progression; the rest falculate.

Zygomatic arch closed. Clavicles perfect. Tail moderate, stout, and acting as a fulcrum or prop.

Genus 1. *Megalonyx*, Jefferson, Cuv. (Syn. *Megatherium*, Desm., Fisch.).

Teeth $\frac{5-5?}{4-4}$, subelliptical, the middle of the crown excavated, the margins slightly prominent.

Fore-legs the longest: the tibia and fibula distinct: the heel-bone long, compressed, and deep: the falcular claws great and compressed.

Species. *Meg. Jeffersoni*, Cuv. (Syn. *Megatherium Jeffersoni*, Desm., Fisch.; *Megalonyx laqueatus*, Harlan[*]).

Genus 2. *Megatherium*, Cuv. (Syn. *Bradypus*, Pander and D'Alton).

Teeth $\frac{5-5}{4-4?}$, contiguous, tetragonal, the crown transversely sulcated. The fore-feet tetradactyle; the hind-feet tridactyle, the two external toes unarmed. The falcular claws great and diversiform; those of the middle toe greatest, and compressed. Femur with an entire (unimpressed) head; tibia concrete with the fibula at each extremity. Astragalus with the anterior face excavated above. Heel-bone long and thick.

Species. *Meg. Cuvieri*, Desm. (Syn. *Bradypus giganteus*, Pander and D'Alton).

Genus 3. *Mylodon*, Owen. (*Megalonyx*, Harlan[†]; *Orycterotherium*, Harlan[‡]).

Teeth $\frac{5-5}{4-4}$ distinct, the anterior upper tooth subelliptical, moderately remote from the rest; the second elliptical; the rest trigonal with the internal face longitudinally sulcated: the anterior lower tooth elliptical, the penultimate tetragonal; the last, which is the greatest, bilobate.

Feet equal: fore-feet pentadactyle; hind-feet tetradactyle; the two external toes in both unarmed, the rest falculate: the falcular claws great, semiconical, and unequal.

Head of the femur impressed by the round ligament: tibia and fibula distinct: astragalus with the anterior face flattened above; heel-bone long and thick.

Species 1. *Myl. Darwinii*, O.

The lower jaw with the symphysis longer and narrower; the second molar subelliptical; the last bisulcate, the internal furrow angular.

Species 2. *Myl. Harlani*, O. (*Megalonyx laqueatus*, Harlan; *Orycterotherium Missouriense*, Harlan.).

Lower jaw with a shorter and wider symphysis; second molar subquadrate; the last trisulcate, the internal furrow bi-angular.

Species 3. *Myl. robustus*, O.

Lower jaw with the symphysis shorter and wider; second molar subtrigonal; the last trisulcate, the internal furrow rounded.

Genus 4. *Scelidotherium*, Owen. (Syn. *Megalonyx*, Lund[§]).

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[*] 'Cor motum suum validissime retinebat, postquam exemptum erat è corpore, per semihorium;—Exempto corde cæterisque visceribus, multo post se movebat et pedes lente contrahebat sicut dormituriens solet.' Pison, *Hist. Bras.* p. 322, quoted by Buffon, who well observes, 'Par ces rapports, ce quadrupède se raproche non-seulement de la tortue, dont il a déjà la lenteur, mais encore des autres reptiles et de tous ceux qui n'ont pas un centre du sentiment unique et bien distinct.' (*Loc. cit.*, p. 45.)

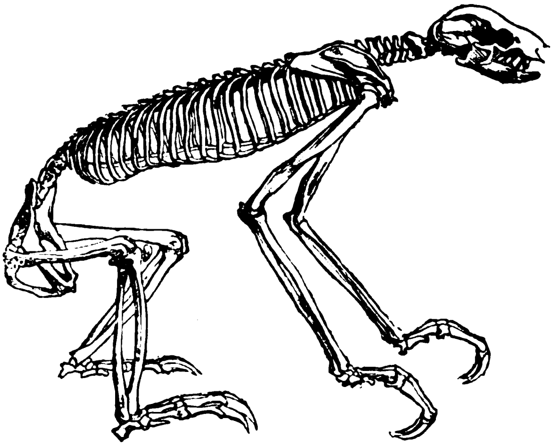
[*] Professor Owen remarks that the species is founded on fossils from Big-Bone Cave, Tenessee, described in the 'Medical and Physical Researches,' pp. 319-331. The author, he observes, does not prove the specific distinction of these remains from the *Megalonyx Jeffersoni* of Cuv.

[†] Professor Owen refers to his genus *Mylodon* the lower jaw described by Dr. Harlan. *loc. cit.* pp. 334-335. It is erroneously, Professor Owen remarks, ascribed to *Megalonyx laqueatus*, or *Pleurodon* of Harlan.

[‡] 'Proceedings of the American Philosophical Society,' vol. ii., No. xx., p. 109.

[§] Professor Owen is in doubt whether the term *Platyonyx*. subsequently proposed by Dr. Lund, be really intended to apply to the animals of the genus *Scelidotherium*, seeing that the breadth of their claw-bones is equalled by the height and vastly exceeded by the length of the same: it would be very descriptive, the Professor says, of the broad ungual bones of the *Glyptodon* and its congeners. The term *Platyonychus* had already been applied by M. Edwards to a genus of crabs.

Teeth $\frac{5-5}{4-4}$, either contiguous or separated by equal intervals; upper ones trigonal; the anterior of the lower ones trigonal, the second and third subcompressed, the external face longitudinally sulcated; the last the greatest and bilobate.



Unau. (De Blainville.)

Head of the femur impressed by the ligamentum teres; tibia and fibula distinct. Astragalus with two excavations anteriorly. Heel-bone long, thick. Falcular claw great and semiconical.

Species. *Scel. leptocephalum*, O.
Scel. Cuvieri, O. (Syn. *Meg. Cuvieri*, Lund).
Scel. Bucklandi, O. (Syn. *Meg. Bucklandi*, Lund).
Scel. minutum, O. (Syn. *Meg. minutus*, Lund).

Genus 5. *Cœlodon*, Lund.

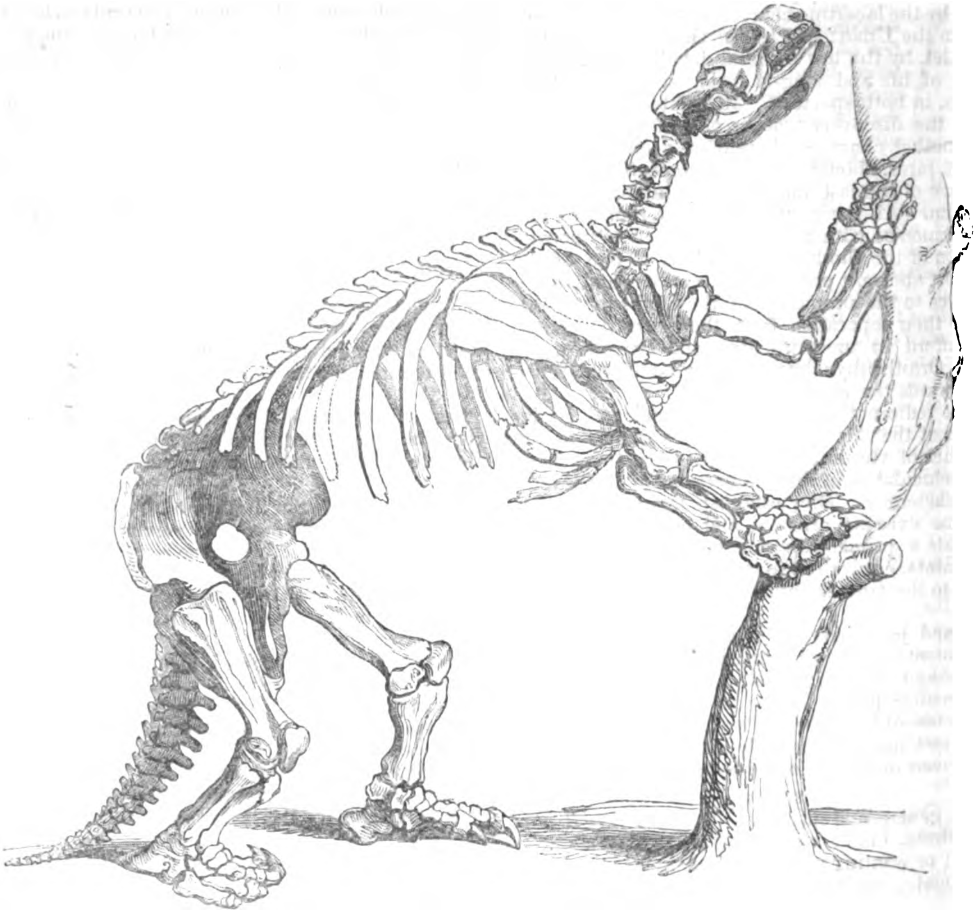
Teeth $\frac{4-4}{3-3}$.

Genus 6. *Sphænodon*, Lund.*

In the Unau the number of cervical vertebræ is seven: in the Three-toed Sloth, *Bradypus tridactylus*, the number is nine.

The close approximation of the Sloths to the Birds in many parts of their organization calls upon us here to notice a discovery which will make the year in which we write (1843) a very remarkable one in the zoological calendar; and before we enter into the particulars of that discovery, we will just illustrate the close approximation above referred to, by observing that if nothing but the broken gigantic pelvis of the bird hereinafter noticed were laid before even an experienced eye, it might fairly enough be taken on a superficial view to have belonged to the genus Mylodon, though a closer examination would detect certain minute characters which show that it could not have belonged to a quadruped.

In the article STRUTHIONIDÆ will be found Professor Owen's descriptions of the fragment of a femur said to have been found in New Zealand, laid before the Zoological Society of London in 1839. [Vol. xxiii., p. 147.]



Mylodon robustus. (Mus. Coll. Chir.)

On the 17th of May, 1842, the Reverend William Williams wrote from Poverty Bay, New Zealand, to Dr. Buckland, and his letter contained an extract from another, sent by way of Port Nicholson, in February of the same year.

'It is about three years ago, on paying a visit to this coast south of the East Cape, that the natives told me of some extraordinary monster, which they said was in existence in an inaccessible cavern on the side of a hill near the river Wairoa, and they showed me at the same time some fragments of bone taken out of the beds of rivers, which they said belonged to this creature, to which they gave the name of Moa. When I came to reside in this neighbourhood I heard the same story a little enlarged; for it was said that this creature was still existing at the said hill, of which the name is Wakapunake, and that it is guarded by a reptile of the Lizard species, but I could not learn that any of the present generation had seen it. I still considered the whole as an idle fable, but offered a large reward to any who would catch me either the bird or its protector. At length a bone was brought from the river running at the foot of the hill, of large size, but the extremities were so much worn away, that I could not determine anything as to its proper relationship. About two months ago a single bone of smaller size was brought from a fresh-water stream in this bay, for which I gave a good payment, and this induced the natives to go in large numbers to turn up the mud at the banks and in the bed of the same river, and soon a larger number of bones was brought of various dimensions. On a comparison with the bones of a fowl, I immediately perceived that they belonged to a bird of gigantic size. The bones of which the greatest number have been brought are the three bones of the leg, a few toe-bones, and one claw, which is

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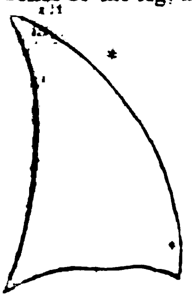
* Professor Owen thinks that both this genus and *Cœlodon*, Lund, are indicated rather than satisfactorily established. The teeth of the Sloth, he observes, are first developed in the form of hollow, obtuse cones, and do not assume the cylindrical form until worn down to the part which has acquired in the progress of growth the normal thickness; and this is afterwards maintained without appreciable alteration during the subsequent uninterrupted growth of the tooth. The compressed molars of the *Scelidotherium*, which, he remarks, doubtless follow the same law of development, would present in the young animal the form of hollow wedges, and such he suspects to be the nature of those teeth which are figured by Dr. Lund in the above-cited Danish memoir, plate xvii., figs. 5-10, and on which he has founded his genus *Sphænodon*



in size*, a few imperfect pelves, a few vertebræ of different dimensions, and one imperfect cranium, which is small. There are also a few broken pieces, which seem to be ribs. In the case now sent you will receive the largest specimens I have obtained, and also a few of smaller size. The length of the large bone of the leg is 2 feet 10 inches. I have a second case, which I shall send by another vessel, to make sure of your receiving them. If the bones are found to be of sufficient interest, I leave it to your judgment to make what use of them you think proper. But if the duplicates reach you, perhaps one set may with propriety be deposited in our museum at Oxford. The following observations may not be devoid of interest:—

'1st. None of these bones have been found on the dry land, but are all of them from the banks and beds of fresh-water rivers, buried only a little distance in the mud. The largest number are from a small stream in Poverty Bay, but they are also found in a similar position at Waiapu, Tologa Bay, Wairoa, and at many inconsiderable streams, and all these streams are in immediate connection with hills of some altitude.

'2nd. This bird was in existence here at no very distant time, though not in the memory of any of the inhabitants; for the bones are found in the beds of the present streams, and do not appear to have been brought into their present situation by the action of any violent rush of waters.

'3rd. That they existed in considerable numbers. I have received perfect and imperfect bones of no less than thirty different birds.

'4th. It may be inferred that this bird was long-lived, and that it was many years before it attained its full size. Out of a large number of bones, only one leg-bone, now sent, is of the size of 2 feet 10 inches; two others are 2 feet 6 inches, one of which I shall send hereafter; the rest are all of inconsiderable size.

'5th. The greatest height of the bird was probably not less than 14 or 16 feet. The leg-bones now sent give the height of six feet from the root of the tail. I am told that the name given by the Malays to the Peacock is the same as that given by the natives to this bird. Within the last few days I have obtained a piece of information worthy of notice. Happening to speak to an American about these bones, he told me that the bird is still in existence in the neighbourhood of Cloudy Bay, in Cook's Straits. He said that the natives there had mentioned to an Englishman belonging to a whaling party that there was a bird of extraordinary size to be seen only at night, on the side of a hill near the place, and that he, with a native and a second Englishman, went to the spot; that after waiting some time they saw the creature at some little distance, which they describe as being about 14 or 16 feet high. One of the men proposed to go nearer and shoot, but his companion was so exceedingly terrified, or perhaps both of them, that they were satisfied with looking at him, when, in a little time, he took the alarm, and strode off up the sides of the mountain.

'This incident might not have been worth mentioning, had it not been for the extraordinary agreement in point of the size of the bird. Here are the bones which will satisfy you that such a bird *has been* in existence, and *there* is said to be the *living bird*, the supposed size of which, given by an independent witness, precisely agrees.

'Should I obtain anything more perfect, you will not fail to hear from me, and in the mean time may I request the favour of your opinion upon these bones, and also the information whether any others of similar character have been found elsewhere. I beg to remain, dear Sir, your obedient servant, W. W.'

On the 10th of January, 1843, Professor Owen read before a meeting of the Zoological Society of London a paper in which he stated, that since the communication of the Rev. Mr. Cotton* relative to the remains of the gigantic bird of New Zealand which had been collected in the North Island, by the Rev. Wm. Williams, one of the boxes of the remains transmitted by that gentleman to Professor Buckland had been received, and that the specimens had been liberally placed in his hands for description.

Professor Owen remarks, that an entire femur, somewhat larger than that of which the shaft (the fragment above alluded to) is described and figured in the Society's *Transactions* (vol. iii., p. 32, pl. 3), proves the specific identity of the remains so sent with that fragment, upon which he had ventured to affirm three years ago, that a large Struthious Bird, 'of a heavier and more sluggish species than the Ostrich,' had recently become extinct, if it were not still living in New Zealand.

The femur, he observes, has very nearly the same proportions of thickness to length as in the Ostrich, but the shaft is less compressed; it consequently differs from that of the *Apteryx* in being shorter in proportion to its thickness; but it resembles the femur of the *Apteryx*, and differs from that of the Ostrich and Emeu in the important character of the absence of the air-hole at the back part of the neck, and the consequent substitution of marrow for air in the interior of the bone. It differs from the femur of the Ostrich and agrees with that of the Apteryx in the greater width of the anterior of the condyles. It differs from that of the Apteryx, not only in the general proportions, but also in the form of the distal extremity, which has a deeper posterior intercondyloid depression, and a sharper and more produced posterior part of the outer condyle.

Professor Owen states that the length of the femur of the great bird compared is 11 inches, the circumference of the middle of the shaft 5½ inches; but he adds, that the collection transmitted by Mr. Williams includes the shaft of a femur of another individual having a circumference of 7½ inches.

The most perfect tibia in the collection under consideration measured 2 feet 4½ inches, and apparently corresponded in proportion with the fragment of the largest femur: allowing, then, that femur 14 inches of entire length, the tibia is twice the length of the femur, while in the Apteryx the tibia is only one-third longer than the femur.

The larger Struthionidæ, the Ostrich and Emeu for example, more nearly resemble the great New Zealand bird, Professor Owen remarks, in the length of their tibia, but it is not quite twice the length of the femur in those species. The tibia of the great New Zealand bird differs, he observes, from that of the *Apteryx* and all the large *Struthionidæ* in the complete osseous canal for the passage of an extensor tendon in the anterior concavity above the distal condyles. This osseous canal is commonly found in the tibia of the *Grallæ*, *Gallinæ*, and *Anseres*. Professor Owen found the proportion of length to thickness of the tibia to be nearly the same in the Ostrich and the great New Zealand bird: the circumference of the tibia at its proximal end in the latter was 15 inches, at its middle 5 inches.

But the most instructive bone in the box sent upon the present occasion was a tarso-metatarsal bone, showing that the gigantic bird was tridactyle, like the Emeu, Rhea, and Cassowary. The remains of the proximal end of the bone proved it to have been articulated with a tibia about an eighth part shorter than that above described, that is, to a tibia about two feet in length. The length of this tarso-metatarsal bone is one foot, or, as Professor Owen remarks, half the length of the tibia; and this is exactly the proportion which the tarso-metatarsal bone of the Apteryx bears to the tibia. The tarso-metatarsal bone in the Emeu is as long as the tibia: in the Ostrich it is a little shorter.

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* This letter corroborates the statements of the Rev. W. Williams.

Professor Owen gives the following comparative admeasurements, showing the difference in the proportions of the tarso-metatarsal bone of the gigantic bird of New Zealand and of the Emeu:—

	Dinornis.		Dromaius.	
	In.	Lin.	In.	Lin.
Length . . .	12	..	14	6
Circumference of the middle	4	5	2	8
Breadth of the distal end	3	10	2	10

and he observes, that the comparative shortness and strength of the trifid metatarsal of the gigantic New Zealand bird forms its most striking resemblance to the Apteryx, which it thus approximates more closely than any of the large existing *Struthionidæ*.

The Professor then goes on to remark, that the proportions of the leg-bones, and their denser texture, especially that of the femur, which, as in the Apteryx, contains no air, sufficiently indicate the generic distinction of the great New Zealand bird from the tridactyle Emeu, Rhea, and Cassowary. Then the question arises, is it, likewise, generically distinct from the *Apteryx*, or is it a gigantic species of that genus? This question he shows to be determined by the tarso-metatarsal bone. The Apteryx, he observes, is distinguished from the other *Struthionidæ*, not more by its elongated bill, than by the presence of a fourth small toe on the inner and back part of the foot, articulated to a slightly elevated rough surface of the tarso-metatarsal bone, about a fourth of the length of that bone from its distal end. Now there is no trace of the articular surface in the tarso-metatarsal of the gigantic bird, which was consequently tridactyle, as in the Emeu, Rhea, and Cassowary. The Dodo was tetradactyle, like the Apteryx: the shorter proportions of the legs of the Dodo also distinguished it from the gigantic bird, whose career, Professor Owen remarks, in the North Island of New Zealand seems to have been closed at a period apparently corresponding with the extinction of the Dodo in the island of Rodriguez. The results of the foregoing comparisons justify the reference of the Great Bird of New Zealand to a distinct genus of the Struthious family, for which Professor Owen proposes the name of *Dinornis*, with the specific appellation *Novæ Zealandiæ*.

In conclusion, Professor Owen observes that the extraordinary size of the tibia above described, and, still more, that of the tibia, said to measure 2 feet 10 inches in length, obtained by Mr. Williams, prove the *Dinornis* of New Zealand to be the most gigantic of known birds: there is, he remarks, extremely little probability that it will ever be found, whether living or extinct, in any other part of the world than the islands of New Zealand or parts adjacent. At all events, he considers that the *Dinornis Novæ Zealandiæ* will always remain one of the most extraordinary of the zoological facts in the history of those islands; and he thinks, most correctly in our opinion, that it may not be saying too much to characterise it as one of the most remarkable acquisitions to zoology in general which the present century has produced. (*Zool. Proc.*)

It is impossible to look at these colossal remains without acknowledging that there is some excuse for the fright of the adventurers who allege that they saw this feathered Goliath in the flesh. The bones are massive: far stouter and broader than those of the other tridactylous Struthionidæ, much stouter and broader, more mammalian, so to speak, than in the Apteryx;* and the bulk of the bird must have been great. The femur of the Irish giant O'Byrne—O'Brian, as he was commonly called, whose skeleton, now in the museum of the College of Surgeons, is eight feet high—is not quite two feet in length: the longest tibia now sent is four inches and a half longer at least, and we have evidence of a tibia measuring two feet ten inches in length. Nor is it by any means clear that the bones already found are the largest in existence. The variety in size of the remains already sent quite bear out the judicious remarks of Mr. Williams, and it *is* difficult to determine what limit there was to the growth of *Dinornis Novæ Zealandiæ*. The comparatively small bones now sent give a height of about fourteen feet.

It is curious and instructive, with these wonderful bones before one, to look back to Professor Owen's description of the fragment of bone which first came under his notice, and to read the deductions which he drew from it. Entirely in the dark, with the exception of the glimmering light which he extracted from that fragment (the mere shaft of the bone, be it remembered), every word that he then wrote has come true to the letter. Long ago he showed us the outline, which he had drawn, of what the ends of this fragment of a femur ought to be; and it is but just to this acute and deep-thinking physiologist to say that if the drawing had been made from the perfect bone it could hardly have been more accurate.

We have remarked that this is instructive; and we think it will not be denied that it shows what may be done in the way of arriving at the structure of an entire animal from a single bone or even the fragment of a bone, notwithstanding the doubts expressed by certain modern French physiologists as to the value of the method of Cuvier and the use of it by his followers. Let us not be misunderstood: it is an instrument not to be wielded by every hand. He who would apply it with any success must have vast experience in all the phases of organic forms and a powerfully comprehensive mind. But because this instrument has been misapplied by the feeble, it is not to be deemed valueless.

Nor is this all. Upon comparing the largest known fossil footstep of a bird with the comparatively small bones belonging to the gigantic bird of New Zealand now in this country, it was not a jot too large to have been impressed by the tridactylous toes of *Dinornis*. What a chapter this opens in the book of ORNITHICHNITES!*

UNCA'RIA, a genus of plants of the natural family of Rubiaceæ, so named by Schreber from *uncus*, a hook, the old or inferior sterile peduncles being converted into hooked axillary spines. Being closely allied, Uncaria is sometimes considered only a subgenus of Nauclea. The flowers are aggregate, on a globular receptacle. Calyx tubularly urceolate, 5-cleft. Corol funnel-shaped, with a slender tube and naked throat. Stamens 5. Ovary 2-celled. Capsules pedicellate, clavate, attenuated at the base. Seeds imbricated, winged. Embryo inverse and furnished with a perisperm. The species are chiefly natives of India, but a few are found in America. They are permanent cirrhiferous ramblers, hanging to different trees by the hooked old peduncles. One is sufficiently remarkable, from its economical uses, to require a detailed notice. This is the Gambier plant, Uncaria Gambier of Roxburgh, a native of Penang, Sumatra, Malacca, &c., from which the substance called Gambier by the Malays is prepared, and which is known in commerce by the names of Terra japonica and Catechu.

This plant was first described by Rumphius, 'Herb. Amb.,' v., p. 63, t. 34, f. 2 and 3, by the name of 'Funis uncatus angustifolius,' but the process of preparing the extract was first fully described by Dr. C. Campbell, one of the early medical officers of the station of Bencoolen, who paid considerable attention to the useful plants of the neighbourhood. He states that it is chewed by the Malays mingled with betel-leaf and areca-nut in the same way that catechu is used on the continent of India, and was solicitous that a trial should be made of its power in tanning. The preparation he describes as simple: 'the young shoot and leaves are shred and bruised in water for some hours, until a feculum is deposited: this, inspissated in the sun to the consistence of a paste, is thrown into moulds of a circular form, and in this state the gambier is brought to market.' In this mode Dr. C. saw it prepared in his journey to Cochin-China, at a small village where the sultan of Moco had established a colony for carrying on the manufacture to a considerable extent. Dr. Roxburgh states that 'in other parts to the eastward of the Bay of Bengal he learned that the process is carried on by boiling the leaves and young shoots; evaporating the decoction by fire and the heat of the sun. When sufficiently inspissated, it is spread out thin, and cut into little square cakes and dried.' Marsden says (*Hist. of Sumatra*, p. 243), that gambier is a substance prepared from the leaves of a tree of that name, by boiling their juices to a consistence, and making it up into little balls or squares. It may be procured at ten dollars per cwt. He refers for a particular detail of the cultivation and manufacture to the 2nd vol. of the 'Trans.' of the Batavian Society. Mr. Hunter (*Linn. Trans.*, ix., p. 220) says, that in Prince of Wales Island the substance is prepared by boiling the leaves for an hour and a half, adding more water as the first wastes, till towards the end of the process, when it is inspissated to the consistence of thin syrup, and when taken off the fire and allowed to cool it becomes solid. It is then cut into little square pieces, which are dried in the sun, and turned frequently. Mr. Bennett, in his 'Wanderings,' has given a very detailed account of the mode of preparing the cubical variety at Singapore. The leaves are plucked from the prunings, and boiled in a cauldron of bark with an iron bottom. The decoction is evaporated to the consistence of a very thick extract, of a light brownish colour, like clay, which is placed in oblong moulds. It is then divided into squares and dried in the sun on raised platforms. The finest varieties are usually retained for chewing; the browner and more strong-tasted are exported to China, &c., and to Europe. The best is made in the Isle of Bintong, the next best in Lingin. In the year 1839 no less than 5213 tons were imported into this country, chiefly for the use of tanners, being powerfully astringent, as it contains from 36 to 40 per cent. of tannin.

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* Professor Owen pointed out to us the strong resemblance of the pelvis of *Dinornis* to that of the Bustard.

* Mr. Lyell has just read to the Geological Society of London a most interesting paper on these fossil footsteps from materials collected by him in America. Dr. Mantell has also called attention to some from the Weald.

UNCIA, the twelfth part of the As. The mathematicians of the seventeenth century frequently used this word to signify the numerical coefficient of an algebraical letter. Thus Halley (*Phil. Trans.*, No. 216) talks of 'that admirable invention of Mr. Newton, whereby he determines the *Unciæ*, or numbers prefixed to the members composing powers,' meaning to speak of what we should now call the numerical coefficients, which enter in any particular case of the binomial theorem.

UNCITES, a fossil genus of Brachiopoda, proposed by Defrance for a shell found in the 'transition' limestone of Paffrath and Gerolstein. It is united by Von Buch with Gypidium of Dalman (supposed to be equivalent to Pentamerus of Sowerby), as a subdivision of Terebratula. Brown, adopting the genus, figures the shell as Uncites Gryphus ('Lithæa Geognost.,' pl. 2, f. 6).

UNDE'CAGON, a figure of eleven sides.

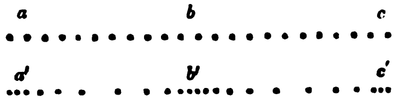
UNDERWRITERS. [SHIPS.]

UNDETERMINED (Mathematics), not known, as distinguished from indeterminate, which cannot be known. Thus, 'What numbers are those whose sum is 100?' is indeterminate: many numbers will satisfy the condition, but the problem contains no mode of distinguishing the answer which is wanted, or of giving a preference to one answer over another. But an undetermined quantity may be determinate, or capable of being determined. There is, however, frequently a want of proper distinction in the use of these words. [INDETERMINATE.]

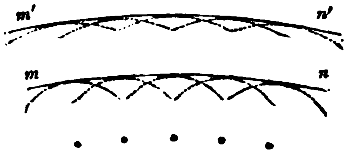
UNDULATORY THEORY OF LIGHT, a theory in which it is attempted to explain the phenomena of light by the supposed vibrations of an ethereal medium.

Descartes is considered as the first who entertained the opinion that vision might be so explained; but that philosopher only states that light may be a certain movement or action of the molecules of air and other pellucid substances. He supposes that the effects may be instantaneously transmitted to the eye; and he compares the apprehension of external objects by vision to that which a blind man obtains when, holding a staff at one of its extremities in the hand, the opposite extremity comes in contact with an obstacle. ('Dioptrices,' cap. 1.) Mallebranche appears to have conceived that there existed an analogy between the phenomena of sound and those of light; ascribing the former to vibratory movements of the particles of air, and the latter to the like movements of the particles of an ethereal medium between the luminous body and the eye. But Huyghens (*Tractatus de Lumine*) both advanced the undulatory hypothesis and explained by it the principal circumstances relating to the reflexion and refraction of light. The hypothesis has since been adopted by many distinguished mathematicians, both in this country and on the Continent, among whom may be mentioned Euler, Dr. Young, MM. Fresnel and Poisson, Sir John Herschel, and Mr. Airy.

In order to understand the mechanism of the undulations, let it be imagined that a particle of a luminous body, as the sun or the flame of a candle, is in any state of vibration at a given moment, and that it causes vibrations in the particles of an elastic ethereal medium about it: also, for simplicity, let it be supposed (the density of the medium being uniform) that the latter particles perform their vibrations to and fro in equal times, within very short and equal distances, on each side of the points at which they would be at rest if the ether were undisturbed, and in the directions of radii from the luminous particle; so that, in the time that any particle performs one vibration to or fro, a certain number of the particles, instead of remaining at equal distances, as in the line ac, will have disposed themselves in the manner shown between the points a' and b', b' and c', and so on. Now, the motions of the ethereal particles in all the radiating lines being supposed equal, the particles which are in the surface of an imaginary sphere having the luminous particle for a centre, will be in like positions or like states of condensation with respect to those which are within and beyond that surface; and the shell, or interval ($=a'b'$, $b'c'$, &c.) between the two nearest surfaces at which the particles are in like states, is called the length of a *wave*, or *undulation:* let this be represented by λ. Then, if T be the time in which any ethereal particle performs one vibration to or fro, and V be the velocity of light (which from astronomical observations is about 192,000 miles per second), we have $VT = \lambda$. If V be expressed in inches, λ will be a very small fraction of an inch; $\frac{1}{\lambda}$ will express the number of undulations $a'b'$ in one inch, and this being multiplied by V in inches will give $\frac{1}{T}$, or the number of undulations which are supposed to be made in one second, or the number of times in which, during one second, an ethereal particle makes a vibration to or fro. As the impulse communicated by the luminous particle continues, the waves advance with the velocity V, their radii increasing in length; so that if the origin of the light is in a celestial body, the surface of the wave at the earth may be considered as a plane.



When the waves from a luminous point arrive at or near any surface which may arrest or change the rate of their progress, every point in such surface is conceived to become the centre from whence, as if it were a new luminous point, proceeds another series of concentric spherical waves, the length λ remaining the same as before if the ethereal medium is the same. The waves thus proceeding from the different points of an object by which the original wave was arrested interfere with one another, but a plane, or curve surface, as $m\,n$, $m'\,n'$, &c., which is a tangent to the surfaces of the secondary waves at points where the particles are in like states, or phases, is to be considered as the front of a wave.



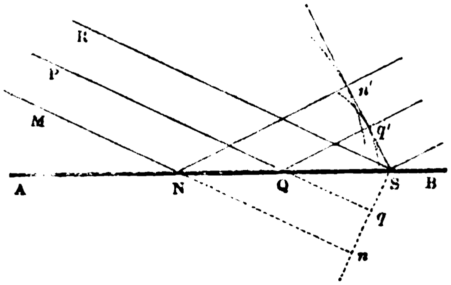
The secondary waves thus arising may be either reflected back from the surface of the medium on which the original wave is incident, or they may be transmitted through that medium: in the latter case they are supposed to be produced either by vibrations immediately communicated to the ethereal matter within the medium, or to this matter through vibrations excited in the particles of the medium itself: but the velocity of the transmitted waves is supposed to be different from that of the incident waves when the density or elasticity of the refracting medium differs from that in which the rays moved previously to their incidence.

The number of vibrations to or fro which an ethereal particle makes in a given time is supposed to determine the colours of natural bodies: but V is constant, since it depends on the homogeneity and uniform elasticity of the ethereal medium; therefore the values of λ and T differ for different colours: the values which cause the perception of redness are the greatest, and those which produce the violet colour are the least.

Undulations are conceived to be of various kinds; that which has been described is analogous to the movement in air by which sound is produced. A second kind may be supposed to be that in which the particles in each radiating line perform, without any movement in the direction of the line, oscillations of small extent alternately on each side of it; the oscillations taking place in directions perpendicular to the line and in one plane: the points where the particles are at the greatest distances from the line on either side are at equal intervals along the line; and each of these intervals constitutes the length of an undulation. This kind of vibration is nearly analogous to that which takes place on the surface of water when a stone has been let fall in it. Both of these kinds of vibration may be conceived to take place at the same time; and the last may be combined with a like vibration in a plane at right angles to the former plane. [POLARIZATION OF LIGHT.] It must be observed that, whatever be the kind of undulation, the greatest excursions of a particle on each side of its mean place are supposed to be equal to a very small fraction of the length, λ, of an undulation.

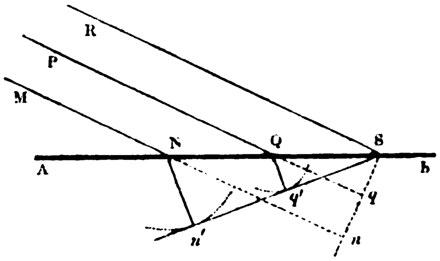
The vibrations produced on the fibres of the retina by the vibrations of the ethereal particles, are supposed to be the cause of the perception of brightness. A single impulse, or one repeated at irregular intervals, may not be capable of producing such perception; but if the impulses are repeated at the same point, corresponding motions may be excited in the fibres, and hence the perception may arise: differences of colour are conceived to depend on the times in which the successive impulses are repeated. From reasonings founded on the fact that no gain or loss of light is experienced in reflexion or refraction, so that the amount of its intensity remains constant however the velocities of the particles may be changed in quantity or sign, it is inferred that the maximum intensity of light in the eye may be expressed by the square of the whole amplitude of the vibrations of the ethereal particles.

In order to exhibit the manner in which reflexion takes place at a plane surface, on the undulatory hypothesis, let the plane of the paper be perpendicular to that of the reflecting surface, and let AB be the line of section; also let MN, PQ, RS be three radii diverging from a luminous point, which, for simplicity, conceive to be at such a distance that the radii may be considered as parallel to one another: again, the successive fronts of the waves being supposed to be plane surfaces, let them intersect the plane of the paper in straight lines perpendicular to the radii. Then the waves which are in part arrested at N and Q would, if there had been no interruption, have continued their motion, and a wave front passing through S would have cut the paper in the line nqS, the ethereal particles in the plane passing through that line being in the like phase.



But, in consequence of the interruption, let spherical waves diverge from N, Q, and S: these moving with the same velocity as the original wave, the radii Nn', Qq' of the waves which diverge from N and Q will be equal to Nn, Qq, at the time that a wave begins to diverge from S: it is evident, therefore, that a straight line passing through S will touch the spherical surfaces at q' and n', and will be the intersection of the front of the reflected wave with the paper. This front will be a plane, and the line S$q'n'$ will make with NS an angle equal to NSn. Perpendiculars to this line, as Nn', Qq' produced, will denote the direction of the motion of the reflected wave; and, from the equality of the triangles SNn', SNn, &c., it follows that this direction will make with a perpendicular to the reflecting surface an angle equal to that which is made by any of the lines MN, PQ, &c. That is, the angle of reflexion is equal to the angle of incidence.

The manner in which ordinary refraction at a plane surface takes place on the undulatory hypothesis is thus explained. Let AB be the intersection of the refracting surface with the paper, and, as before, let MN, PQ, RS be three radii supposed to be parallel to one another; also let nqS be the front of a wave which would have been formed if there had been no interruption. Now, in consequence of the interruption, let agitations be excited in the ether within the body, so that N, Q, and S become the centres of spherical waves whose particular fronts n', q', and S advance in the medium with velocities equal to one another, but different from that of the original wave before incidence: let Qq be to Qq', and Nn to Nn', in the same ratio as the velocities of the waves previously and subsequently to the time of incidence (suppose as m to 1); then S$q'n'$ will be a straight line, and will represent the intersection of the plane front of the refracted wave with the plane of the paper. The angles NSn, NSn', are equal to those which the directions of the incident and refracted waves make with a perpendicular to the refracting surface; therefore



Nn : Nn' (m : 1) :: sine of incidence : sine of refraction (see also LIGHT, p. 476, col. 2), and the velocities of the waves before and after incidence are to one another as the sine of incidence is to the sine of refraction.

In order that the relation between the sines of incidence and refraction may be conformable to the results of experiment, it is necessary to assume that the velocity of the waves is diminished when they enter a medium more dense than that in which they previously moved; and in this circumstance the undulatory theory is opposed to the theory of emission: for, in the latter, the velocity of light is supposed to be increased when it passes from any medium into one more dense.

When concentric waves fall on the surface of a concave mirror, the points on the latter which are struck by the vibrating particles of ether become the centres of spherical reflected waves, the directions of whose motions, on account of the equality of the angles of incidence and reflexion, tend towards the axis of the mirror; and the surfaces which touch all the reflected waves at points in the like phase become those of as many general reflected waves of spherical forms, having their convexities towards the mirror. These general waves go on contracting till they pass successively through some point in the axis; the form of the mirror being such as to permit the directions of the motions of the reflected waves to concur in a point: from this point, which is the focus of the mirror, they afterwards diverge as from a radiant point. It is easy to conceive that the general front of a wave formed by a surface which touches, at points where the ethereal particles are in the like phase, the surfaces of waves refracted in a transparent medium (at a convex surface for example), will be spherical, and will have its convexity towards the refracting surface. These waves will go on contracting, and pass successively through some point in the axis, provided the form of the surface of the medium be such as to permit the directions to concur in one point: this point is the focus, and from it, as from a radiant point, the concentric waves afterwards diverge.

When several undulations coexist, they are said to interfere with one another; and assuming that the displacement of a particle produced by any number of coexisting undulations may be expressed by the sum of the displacements which the undulations would separately produce, the rules of integration will give the whole amount of the disturbance produced by the interference of any number of waves. When, for example, two waves are equal in length, the greatest amplitudes of vibration may occur at places which are at intervals from one another equal to λ, 2λ, 3λ, &c.; and if the amplitudes are equal, the whole amplitude of vibration will be double that of one particle alone: thus on a screen the light produced by the two undulations will be twice as great as that which would be produced by one. On the other hand, if two equal undulations are transmitted in the same direction, and the one follows the other at an interval equal to $\frac{1}{2}\lambda$, $\frac{3}{2}\lambda$, $\frac{5}{2}\lambda$, the maximum of amplitude in one will coincide with the minimum in the other, and the effects will be destroyed, or the particles will be at rest, and on a screen darkness will be the result. If the undulations follow at other distances, the destruction of the vibrations will be incomplete, and on the screen the brightness will have some intermediate degree of intensity.

With respect to polarized light, the experiments of MM. Fresnel and Arago have shown that two series of waves which are polarized in the same plane interfere with one another in the manner just mentioned, as if the light were not polarized: also that if two series of waves are polarized in planes at right angles to each other, and are in circumstances similar to those in which the waves of common light would destroy each other's disturbances, their interference produces no effect.

On the corpuscular hypothesis, if the particles of light are supposed to proceed from a luminous point in directions strictly rectilinear, it must follow that the shadow cast on a screen by an opaque body would have a well-defined boundary; also that its magnitude would depend on that of the body and on the distance of the latter from the luminous point and from the screen. But before the year 1663 Grimaldi had observed that when a pencil of light was received in a dark room through a small circular orifice, the rays, instead of continuing to be parallel to one another, diverged in a conical manner; and that the shadow cast by an opaque body was bordered by coloured bands or fringes: he also observed that when light was admitted through two small orifices near one another, the rays diverging from thence became intermixed, and that the space on the screen on which the intermingled rays fell was darker than the part enlightened only by the rays from one orifice. A few years afterwards Dr. Hooke, in this country, observed the like phenomena, and published an account of them in his 'Micrographia' (1665). The impossibility at that time of giving a satisfactory explanation of these appearances seems to have led Huygens to propose the theory of undulations.

When Newton had succeeded in explaining the phenomena of the concentric coloured rings which are formed between the surfaces of two prisms or convex lenses of glass, by assuming that the particles of light in a refracting medium experience alternately, at the end of very small and equal intervals, fits of easy reflexion and of easy transmission, he applied the principle to the passage of rays near the edge of an opaque body. He conceived that by alternate fits of easy attraction and repulsion in the particles of light the rays might assume a serpentine form; and that from corresponding points in the flexures they might send off particles in lines which, crossing one another, would form series of points where the light would be more condensed than in the intermediate spaces. The order and magnitudes of the bands or fringes thus produced on a screen have to a certain extent been explained by Newton's hypothesis, but the theory of the interference of waves has been shown by Dr. Young and M. Fresnel to account completely for the phenomena: it does not however follow that the corpuscular theory is incapable of affording an equally satisfactory explanation. [DIFFRACTION, col. 2.]

From the first principles of the undulatory theory it follows that the coloured rings between two lenses, when seen by reflexion, should be of the same kind and in the same order as the rings seen by transmission, beginning with a bright spot in the centre (for the interval between the lenses vanishes at the point of contact, and therefore the waves reflected from both surfaces to the eye must there be in like states), whereas the central spot seen by reflection is quite black, and the waves must consequently destroy one another's effects. In order to reconcile this discrepancy, it becomes necessary to suppose that half an undulation is lost or gained by the waves reflected either from the first or second surface; and the supposition is considered by no means improbable, since there may exist some variation from its general state, in the density or elasticity of the ether at the surfaces of the lenses. It must also be observed that when light falls on the lenses at great angles of incidence, the dilatations of the rings, computed on the undulatory hypothesis, differ considerably from the results of experiment: no cause has yet been assigned for this circumstance, but it has been supposed that it may arise from variations in the general law of refraction when the incidences are great.

It was objected by Newton to the undulatory theory, that, if just, light passing by the edges of an opaque body ought to be inflected into the shadow cast by the body, as waves of air and water flow round any obstacle which may be in the direction of their motion: the difficulty has not wholly been removed; but it is well known that such inflexions do really take place to a certain extent, and the circumstances attending them have been fully explained by the theory. Dr. Young allowed a diverging pencil of light to pass into a dark room through a very small orifice, and having placed in the pencil a narrow and opaque body with parallel sides, he observed that the shadow which the body cast on a screen was divided by parallel coloured bands alternately dark and bright, the band in the middle being always bright. Now, that this appearance resulted from the interference of the light after being deflected at the edges of the opaque body was evident, because on intercepting the light at one side of the body, the bands immediately disappeared. In order to account for the appearance of the bands on the undulatory hypothesis, it is only necessary to observe, that, the paths of the waves of light from the edges of the body to a point on the screen opposite its centre being equal to one another, the fronts of the interfering waves must arrive at that centre in the same state; and their effects being added together, there must result a maximum of brightness: but the paths of the waves from the edges of the body to any other part of the shadow on the screen will be unequal; and at every place where the difference is exactly an uneven multiple of $\frac{1}{2}\lambda$, the waves must arrive in opposite phases, and thus destroy each other's effects, or produce darkness: between these dark bands the degrees of brightness will depend upon the states of the interfering waves at those places. If the incident light is homogeneous, or of one colour, all the bright bands are of that colour, and the intervals between them are black.

Besides the bands so formed within the geometrical shadow of the body, a series of parallel bands was also observed on the exterior and on each side of that shadow: these, like the fringes noticed by Grimaldi and Newton, are conceived to be produced by the interference of the waves of light which come directly from the luminous point with those which are deflected at the edges of the opaque body; but, in order that the results of theory may be conformable to experiment, Dr. Young found it necessary to assume that there is a gain or a loss of half the length of a wave in the paths of those which are deflected; as in the application of the principle of interference to the coloured rings observed by reflexion between glass lenses.

The gain or loss of half an undulation must also be allowed for in explaining the phenomena of the bands or fringes produced by polarized light. Thus, when a series of polarized waves is made to pass through a lamina of sulphate of lime whose principal section is inclined at 45° to the plane of original polarization, the waves become divided into two series parallel to one another and moving with different velocities: then, if a thick rhomboid of Iceland spar is placed so as to receive the 'ordinary' and 'extraordinary' waves when transmitted through two small orifices in an opaque plate, each series gives rise to three sets of coloured bands. But when there is so placed a thin plate of spar by which the courses of the two sets of waves are not sensibly separated from each other, instead of three sets of bands, only one is observed: hence it follows according to the theory, that half an undulation is gained or lost at the place where the extraordinary waves separate from the others; or that the two series of waves become polarized in planes at right angles to one another, so as to be prevented from assuming the state of interference by which coloured bands would be produced.

That the inflexions of the luminiferous waves about the sides of any obstacle to their direct progress are inconsiderable may be supposed to arise from the shortness of the undulations in an ethereal medium compared with the extent of the resisting surface: on which account the lateral disturbances arising from their interference with one another decrease with great rapidity and soon become insensible.

Phenomena similar to those which have been mentioned are exhibited when a pencil of light, admitted into a dark room and allowed to pass through an orifice, is received on a screen. If the orifice is a narrow slit with parallel sides, the image on the screen will be a series of parallel bars, alternately dark and bright, and symmetrically disposed on each side of a bright bar in the centre: if the orifice is circular, the central image is either a bright or a dark spot according to the distance of the screen, and about it are concentric coloured rings. It is remarkable that if the pencil of light falls upon an opaque object of small dimensions, the place on the screen where the geometrical image of that object should fall is bright, and of the same intensity as it would have been if no object had been interposed.

The breadths of the bands, and the diameters of the concentric circles of light and darkness, are found to depend on the breadth or diameter of the aperture, and not on the nature of the material by which the diffraction is produced; and Dr. Young considers this circumstance as a strong argument against the opinion that the phenomena are the results of attractive and repulsive forces exercised by the edges of the material on the particles of light. But, at the same time, it may be observed that some discrepancies between the results of the undulatory theory and the phenomena of diffraction within the shadows of small circular discs have been pointed out by Professor Potter of University College, London.

From the breadths of the bands produced by the diffraction of light are obtained the lengths of the waves of different colours; and a convenient method of forming the bands for this purpose consists in causing the light to be reflected from two mirrors inclined to each other at a very small angle, or to be refracted through a triangular prism, two of whose sides make very small angles with the third: the light is allowed to diverge from a luminous point, and, after reflexion or refraction, the interference of the waves will produce parallel bands, alternately dark and light, on a screen. By the undulatory theory the distance of any bright or dark band from the middle of the spectrum depends directly on the length of the wave and inversely on the inclination of the mirrors, or of the sides of the prism, to each other; and since the inclination may be made very small, the length λ of the wave can be determined with great precision. This length, for the extreme red colour, has been found to be 0·0000266 inches, and for the extreme violet colour 0·0000167 inches. The length of a wave for each colour is very nearly four times the length of a fit of easy reflexion, or easy refraction in the corpuscular hypothesis.

In the wave theory it is assumed that common white light is caused by the combined undulations of the ethereal medium, when waves of different lengths are mixed together; and the most serious difficulty to which that theory is subject lies in the imperfect explanation which it affords of the unequal refrangibilities of different colours. That there are no appreciable differences in the velocities of light of different colours, may be inferred from the following consideration among others:—if such differences exist, a satellite of Jupiter, on entering into the shadow of that planet, would appear to be successively tinted with different colours, which is not the case. Hence, as refraction depends on the difference between the velocities of the waves in the ether on the exterior and in the interior of the refracting medium, these velocities must have a constant ratio to each other for light of all colours; it should follow, therefore, that no dispersion of the colours after refraction can take place: this is contrary to fact, and the only attempt which has been made to remove the difficulty consists in assuming that the vibrations of the ether in refracting media are variously affected by the vibrations of the particles of the medium itself. Mr. Airy suggests that the development of the action caused by the particles of a refracting medium may depend on time, and on that account it may give rise to unequal refrangibilities by producing differences in the velocities with which waves are transmitted through the medium. (*Mathematical Tracts*, pp. 285-6, note.)

Much stress is laid on the accuracy with which the phenomena of diffraction are accounted for on the undulatory hypothesis; but while there yet remains unexplained by that hypothesis so important a circumstance as the different refrangibilities of light, which are satisfactorily accounted for on the corpuscular theory, and while our knowledge of the action of material particles on one another, as well as of the propagation of motion through elastic media, is so imperfect, philosophers seem to be fully justified in suspending their judgment concerning the relative merits of the two rival theories.

UNGER, JOHANN FRIEDRICH GOTTLIEB, was born in 1750, at Berlin. His father, Johann Georg Unger, distinguished himself greatly by the improvements which he introduced into printing, and the typographical ornaments then usually displayed in printed books. The art of wood-cutting, which had fallen into neglect, was revived by him, and he engraved in wood several landscapes, which are even now considered as works of art. When he died, in 1788, his son, who was established as a publisher and printer, followed in the footsteps of his father. He became one of the most distinguished printers and wood-cutters of his time. As a printer, he endeavoured to introduce such changes in the types of the German printed characters as would bring them nearer to the Roman, and remove their old-fashioned and angular forms. The kind of types which he introduced were called, after him, Ungerian types (Unger'sche Schrift), and were used for a time very extensively, but afterwards they gave way to the old forms. The art of wood-cutting was much improved by him, and he was the first who raised it to a high degree of estimation in Germany. As an acknowledgment of his merits, he was appointed, in the year 1800, professor at the Academy of Arts at Berlin, of which he had been a member for some years. At the same time he continued his business as a publisher, and many excellent works appeared from his establishment. He died in 1804, and his wife, Friederike Helen Unger, a woman of very great acquirements and talent, continued his business until her death, on the 21st of September, 1813. Friederike Unger acquired a considerable reputation as a writer of novels, and as a translator from the French and English, with which two languages she was perfectly familiar. Her novels, which are still much read, are chiefly praised for their beautiful delineation of character. The best among them are:—1, 'Julchen Grünthal, eine Pensionsgeschichte' (Julia Grünthal, or the History of a Girl at a Boarding-school), Berlin, 1794, 8vo. A third and much enlarged edition, in 2 vols., appeared in 1798. It is translated into several languages. 2, 'Bekenntnisse einer Schönen Seele' (Confessions of a fair Saint), Berlin, 1806; 3, 'Der junge Franzose und das Deutsche Mädchen' (The young Frenchman and the German Girl), Hamburg, 1810. Most of her works appeared without her name.

UNGHVAR, a county of the kingdom of Hungary, in the circle on this side of the Theiss, is bounded on the north by Galicia, on the east by the county of Beregh, on the south-east by Szaboltz, and on the south-west and west by Zemplin. The greater part of the country is covered with mountains, which are branches of the Carpathians: only the smaller south-western portions form part of the great plain of the kingdom, which has a good and fertile soil. The principal rivers are the Ungh, the Laborza, and the Latorza. The natural productions are oats, rye, a small quantity of barley and wheat, wine, and a great abundance of hemp. The area is about 1250 square miles. Nearly one-half of the productive part of the country is covered with forests, and large numbers of swine are driven from great distances to be fattened on the mast of these oak-forests. On the branch of the Carpathians called the Beszkid there are fine pine-forests. These forests abound in most kinds of game. Fish and bees are in abundance. Horned cattle are sufficient for the supply of the inhabitants. The minerals are iron, some gold, and also marble. The county has 84,250 inhabitants (now probably nearly 90,000), of whom, in 1833, 62,000 were Roman Catholics (chiefly United Greeks), 12,000 Protestants, and 5000 Jews.

Unghvar, the chief town of the above county, is situated in 48° 33′ N. lat. and 22° 22′ E. long., on the river Ungh, at the place where it issues from the mountains and dark forests, 1272 feet above the Mediterranean. The situation is extremely pleasant, with fine views of the Hegyallya and the great plain. Unghvar has an antient castle, which is kept in good repair and inhabited: it was well fortified so far back as the ninth century, when it was taken by the Hungarians under Arpad. The bishop of Munkatz and his chapter reside in this castle. There are in the town a seminary for young clergymen, a Roman Catholic gymnasium, a very fine principal church, a newly erected county-hall, which is spoken of as a remarkably beautiful edifice, the former Jesuits' college, the public granary, and several other handsome buildings. The population is about 6500. At the village of Szobranz, at a short distance to the north-west, there is a sulphureous bath, which is celebrated throughout Hungary, but it must be warmed before it is used. The water is likewise taken internally.

(Blumenbach, *Gemälde der Oesterreichischen Monarchie Beschreibung von Ungarn, Croatien, Slavonien*; Hassel, *Handbuch*.)

UNGKA-ETAM, the Asiatic name for *Hylobates Rafflesii*, Geoffr., one of the Gibbons, or Long-armed Apes. [HYLOBATES.]

Description.—Hair thick, furry, black, but in some lights deep brown; loins, and thighs externally, lighter, being of a pale coffee hue. Face encircled with white hair, which is narrow across the forehead; but upon the cheeks expands into large bushy whiskers, which unite under the chin. Back of the hands and feet black; face, palms, and soles dark blue; hair on fore-arm reversed towards the elbow. There are fourteen pairs of ribs.

Locality.—Sumatra, in the neighbourhood of Padang, where it is said to be very rare. [UNGKA-PUTI.]

UNGKA-PUTI, an Asiatic name for *Hylobates agilis*, one of the Gibbons. [HYLOBATES, vol. xii., p. 407.[*]]

Description.—*Male*.—Head, shoulders, inside of the arms, fore-arms, legs, thighs, breast, and belly, deep coffee hue; under surface of the body darker than the upper surface. Hind head, back, and loins, from behind the shoulders to the end of the body, and thighs, externally light blond. Cheeks covered with large white whiskers, united above by a narrow band of the same colour across the lower part of the forehead. Callosities encircled by a few brown hairs. First joints of the fore and middle fingers behind united. Face bluish-black. Eyes sunk. Brows large and projecting. Hair of the head with a backward direction. Canine teeth very long and projecting. Fur soft and woolly.

Female.—Face browner than that of the male; whiskers not so large, and more obscure; eyebrows not so projecting; breast and belly less hairy.

Colour of the *young* nearly the same as that of adults, but less intense; always however darker on the anterior part of the body than on the posterior.

Localities.—Malay Peninsula and the large islands of the Indian Archipelago.

Habits, &c.—Sir Stamford Raffles states that both the Ungka-etam and Ungka-puti are more timid than the Siamang, and are without its strength and boldness. The people of the country where it resides believe that the Ungka-puti will die of grief if it sees a preference given to another. In confirmation of this, Sir Stamford remarks that one in his possession sickened under such circumstances, and did not recover until relieved from the cause of his vexation by the removal of his rival, a Siamang, to another apartment.

M. Duvaucel observes that the Ungka-puti lives more frequently in couples than in families, and is the least common of the genus found in the neighbourhood of Bencoolen. Strongly contrasted with the Siamang, it is, he says, surprisingly agile, darting away like a bird; and, like some birds, is only to be shot, so to speak, flying. Upon the perception of the most distant approach of danger, it is soon far away. Rapidly ascending to the tree-tops, it grasps the most flexible branches; and after balancing itself, and acquiring sufficient impetus, it repeatedly springs, apparently without effort or fatigue, to the distance of forty feet and more.

As a domesticated pet, M. Duvaucel gives it credit for no extraordinary faculty. It is, he remarks, not so clumsy as the Siamang, and its movements are more ready and graceful; but, in his opinion, its manners are less lively than those of the monkey-tribe generally. Looking only at the external appearance of its long and slender arms and short bandy legs, one would not suppose that its muscle was so vigorous and its address so surprising; but M. Duvaucel adds that a large portion of intelligence does not seem to have been allotted to it: in this respect he considers it to be in no way superior to the Siamang; and he observes that both species are without the high and expanded forehead indicative of superior intelligence. What he had seen however convinced him that the Ungka-puti is susceptible of education to a certain point. It has not, he says, the imperturbable gravity of the Siamang: it may be terrified or pleased: it flies from danger, and appreciates good treatment; and he characterises it as greedy, curious, and, occasionally, even gay. Although without the guttural sac of the Siamang, its cry, he remarks, is very nearly the same; and he states that the Ungka-puti is known by various names to the Sumatran natives: among others, Wou-wou, a designation by which another species, *Hylobates leuciscus*, has long been distinguished.

We agree in thinking, with the author of the 'Natural History of Lemurs, Monkeys, and Opossums,'[*] that M. Duvaucel must have drawn his portraits of the Ungka-puti and the Siamang from animals in a state of debility and disease. Mr. George Bennett's interesting account of the Siamang, in his 'Wanderings,' is much at variance with that of the able French naturalist, and places that species in a very different light as to its intelligence, affection, and discrimination. With regard to *Hylobates agilis*, those individuals which we have seen have been remarkable for their intelligence and sensibility. The Ungka-puti is a very affectionate creature: it has been known to seek out and fondle a baby, laying its face close to the cheek of the infant, which remained perfectly at ease under the caress of its long-armed strange companion. It seemed to have some fun about it, for it would lie in the bosom of a gentleman to whom it belonged, look him kindly in the face, and then, with its length of arm passed round him, pick his waistcoat pocket opposite to the side on which it was reposing, apparently thinking of nothing at all, of a cigar, or anything on which it could lay its lean lengthened fingers. In the same spirit it would frolic with an Orang. Light as a fairy, and quick in its unerring motions as a bird, it would sportively elude all the efforts of its comparatively unwieldy Caliban of a playmate to catch it. Darting suddenly from a distance to some holdfast, it would suspend itself by its arms over the head of the Orang, and spin itself as it were, like some intrusive insect, about the eyes and nose of the more sedate ape, avoiding the grasp of the latter with astonishing adroitness. After a time it would suffer itself to be caught by the Orang, who would soon let it go, again to resume its amusing agile tricks and mercurial motions. Many of our readers must have witnesssed such a scene, and listened with curious attention to the long, loud, and not unmusical notes uttered by this species, especially in the morning.

UNGUENTS, or ointments, are unctuous substances, for external application, and intended to answer a variety of purposes, according to their composition. They are variously designated according to their nature and consistence. At one stage of surgery they were of a very complicated kind, as may still be seen in the so-called balsams (artificial) of the continental pharmacopœias; but the progress of modern science leading to greater simplicity, their numbers are much reduced, and their ingredients fewer. If they are composed chiefly of wax, without resin, and of oil, with or without other more active materials, and have a consistence nearly as great as that of plasters, they are termed *cerates*; when fats or resin are used, so that the consistence is scarcely greater than that of butter, they are termed *ointments*; if distilled fragrant waters or essential oils are used, they are termed *pomatums*, or *pomades*; and occasionally, if the appearance correspond, some are termed *butters*, or *pastes*, such as *almond paste*, which, being bland and emollient, must be carefully distinguished from some other compounds also called butters [BUTTERS, in Pharmacy], which are acrid and corrosive, such as butter of antimony, or violent poisons, such as butter of arsenic. Most ointments are formed by melting together the ingredients, and in doing this the heat should never exceed that of the boiling-point of water. To ensure uniformity and smoothness, not only should the ingredients be carefully stirred while on the fire, but they should be strained through a cloth while yet in the liquid state: if essential oils are used, these must be added afterwards. Some are made by merely triturating the materials together, as in the case of mercurial ointment. No great quantity of any ointment should be prepared at one time, as they are apt to undergo changes, sometimes very detrimental, either by the ingredients acting on each other, or by absorbing oxygen from the air. Many should be prepared only when wanted, such as the ointment of the nitrate of silver.

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[*] We are now enabled to give a more accurate description of the animal and its habits.

[*] London, 12mo., Knight and Co.

The chief use of ointments is either by their emollient qualities to soften tense or hardened parts, or to sheath excoriated parts from acrid secretions or the irritation of the air. Applied to ulcers, they may, according to their nature, besides excluding the air, promote the healing, if judiciously used, or hinder it if improperly used. For chapped hands or rough skins, one of the mildest and safest applications is almond-paste.

UNGUICULATA. Linnæus divided the *Mammalia* into the following sections:—*Unguiculata*, UNGULATA, and *Mutica*. [WHALES.]

The *Unguiculata*, or *Clawed Mammals*, included the orders *Bruta*, *Glires*, *Primates*, and *Feræ*.

UNGULA. The hoof of a horse looks like the part of a cone which is separated from the part containing the vertex by an oblique plane. Hence such a solid is called an ungula, and rules for the determination of its content are given in books of mensuration.

END OF VOLUME THE TWENTY-FIFTH.

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